Sperry Univac 1100/60 System

MANAGEMENT SUMMARY

The Sperry Univac 1100/60 System represents the smallest member of the currently active 1100 Series family, which also includes the 1100/80 (report 70C-877-14) and the 1100/90 (Report 70C-877-16).

The 1100/60 System was the first mainframe to make use of multi-microprocessor architecture. The arithmetic and logic portions of the 1100/60 employ sets of nine Motorola 10800 microprocessors (4-bit slice) combined with ECL circuitry and multilayer packaging. Sperry Univac terms these sets microexecution units, which concurrently execute parts of the same microinstructions for improved throughput.

A fundamental consideration in the 1100/60 system design was the provision of high availability, reliability, and maintainability (ARM). Sperry Univac has implemented ARM through such techniques as duplicate micro-execution units, and duplicates of the shifter, logic function, and control store address generator. Further, an instruction retry mechanism is included that allows the system to recover from most transient faults, transparent to the operating environment.

TRACE, the Total Remote Assistance Center, is another step Sperry Univac has taken to implement ARM. TRACE provides remote hardware maintenance from Roseville, Minnesota via phone lines. Software maintenance is still being handled from local offices.

PROCESSORS

The 1100/60 processors are available in seven basic models. The entry-level B and C models do not include ➢

The 1100/60 is a family of medium- to large-scale computer systems that feature a multiple-microprocessor implementation of the 1100 Series architecture. Both uni-processor and multiprocessor configurations are available.

MODELS: 1100/61 B1, C1, C2, E1, E2, H1, and H2; 1100/62 E1MP, E2MP, H1MP, and H2MP; 1100/63 H1MP and H2MP; and 1100/64 H1MP and H2MP.
CONFIGURATION: From 1 to 4 CPUs, 512K to 8192K words of main memory, 1 to 4 IOUs, and 1 to 7 consoles.
COMPETITION: Burroughs B 5900 and B 6900, Control Data Cyber 170 Series, Digital Equipment DECsystem 10, Honeywell DPS8, and IBM 303X, 4331, and 4341.
PRICE: Purchase prices for basic Processing Complexes range from $236,519 to $2,817,332.

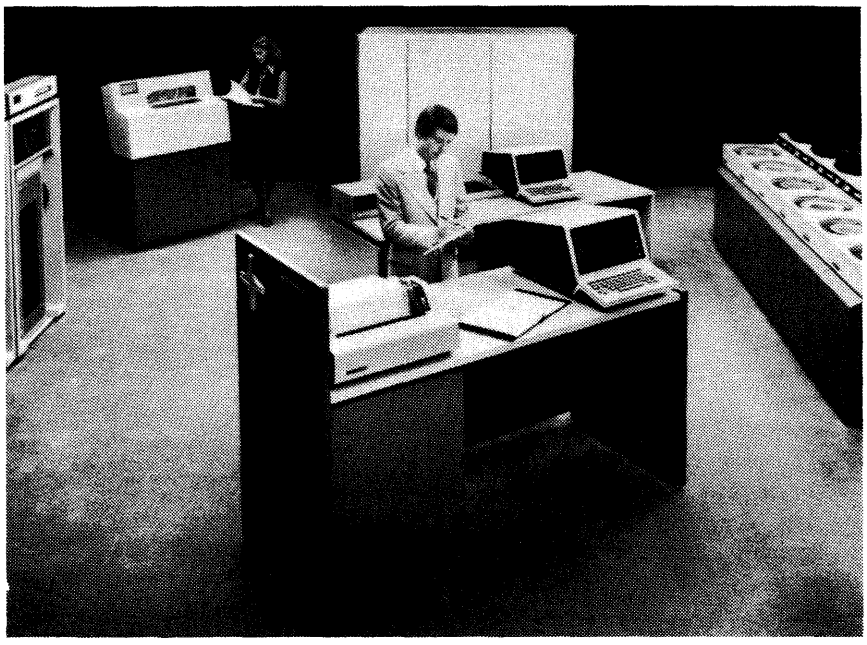
CHARACTERISTICS

MANUFACTURER: Sperry Univac Division, Sperry Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011.

DATE ANNOUNCED: June 1979.

DATE OF FIRST DELIVERY: January 1980.

MODELS: 1100/61 B1, C1, C2, E1, E2, H1, and H2; 1100/62 E1MP, E2MP, H1MP, and H2MP; 1100/63 H1MP and H2MP; and 1100/64 H1MP and H2MP. ➢



The 1100/60 System supports up to 4 central processors and up to 8192K words of main memory. A single processor configuration can include a maximum of four consoles; a multiprocessor configuration, a maximum of seven consoles.

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buffer storage. The medium-performance E models include 2K words of buffer storage, while the high-performance H models include 8K words of buffer storage. Models B1, C1, E1, and H1 use the standard 1100 Series instruction set. Models C2, E2, and H2 include the Extended Instruction Set (EIS), which is designed to enhance the performance of high-level languages and system software. The C1, E1, and H1 can be upgraded to a C2, E2, or H2 with the addition of the EIS. In addition, the B model can be upgraded to a C model, the C models can be upgraded to E models, and the E models can be upgraded to H models.

Seven uniprocessor configurations and eight multiprocessor configurations are available. The 1100/61 and 1100/62 systems include one and two central processors, respectively. In November 1981, Sperry Univac announced the three-processor 1100/63 and the four-processor 1100/64. An 1100/61 system can include any processor model in the 1100/60 series. An 1100/62 system can include a Model E1, E2, H1, or H2 processor. The 1100/63 and 1100/64 systems can be configured with Model H1 or H2 processors only.

The 1100/62 Model E1 or E2 comes packaged as a dual-processor system and can also be configured by adding a Multiprocessor Upgrade feature to an 1100/61 E1 or E2. Multiprocessor Upgrade features are available to upgrade a Model H1 or H2 from an 1100/61 to an 1100/62, an 1100/62 to an 1100/63, or an 1100/63 to an 1100/64.

The basic 1100/60 Processor Complex consists of the CPU, main memory, buffer storage (Models E and H only), System Support Processor (SSP), I/O Unit (IOU), and system console with printer. Multiprocessor systems also include a maintenance console. The SSP provides system management, support for diagnostics and maintenance, and console handling. Each standard IOU includes one block multiplexer channel and four word channels. An IOU can be expanded to include 3 block multiplexer and 8 word channels, 2 block multiplexer and 12 word channels, or 5 block multiplexer and 4 word channels.

Originally, main memory was housed in the 1100/60 processor cabinet. However, Sperry Univac expanded the memory capacity of the 1100/60 systems by adding a separate memory cabinet for Models C, E, and H. Main memory capacity now ranges from 512K words (2 megabytes) to 1024K words (4 megabytes) on the B model, 512K words to 4096K words (16 megabytes) on the C models, and from 512K words to 8192K words (32 megabytes) on the E and H models. The older memory is composed of 16K-bit chips, but the new external memory uses 64K-bit chips. Current users can upgrade to the new external memory unit by ordering the appropriate memory upgrade features. New customers can order the 1100/60 C, E, and H systems with a minimum of 1024K words housed in the external memory cabinet.

Sperry Univac also offers the 1100/60 Attached Virtual Processor (AVP) for users upgrading from a Series 90/60

DATA FORMATS

BASIC UNIT: 36-bit word. In main storage, each word location includes four additional parity bits.

FIXED-POINT OPERANDS: One 36-bit single precision word. Addition and subtraction can also be performed upon 2-word (72-bit) double precision operands and upon 18-bit half-words and 12-bit third-words; the leftmost bit holds the sign in each case. Moreover, partial words of 6, 9, 12, or 18 bits can be transferred into and out of the arithmetic and control registers. The 1100/60 C2, E2, and H2 models can perform decimal addition and subtraction operations on 9-bit bytes, packed 4 to a word.

FLOATING-POINT OPERANDS: One word, consisting of 27-bit-plus-sign fraction and 8-bit exponent for single precision; or two words, consisting of 60-bit-plus-sign fraction and 11-bit exponent for double precision. The range for single precision is from 10 to the 38th power to 10 to the minus 38th power with 8-digit precision; for double precision, the range is 10 to the 307th power to 10 to the minus 308th power with 18-digit precision. The sign is the most significant bit in single precision (bit 35) and double precision (bit 71). Negative floating point numbers are represented by the ones complement of the entire corresponding positive floating point number. Single precision negative exponents are biased by 128, while double precision negative exponents are biased by 1024.

INSTRUCTIONS: One word, consisting of 6-bit Function Code, 4-bit Partial-Word or Immediate-Operand Designator, 4-bit Control Register Designator, 4-bit Index Register Designator, 1-bit Index Modification Designator, 1-bit Indirect Address Designator, and 16-bit Address Field.

INTERNAL CODE: Sperry Univac communications terminals and other I/O units can employ a 6-bit Fieldata code or standard ASCII code. The 1100 processors are not code-sensitive and can manipulate data in 6-bit, 9-bit, 12-bit, or 18-bit codes.

MAIN STORAGE

STORAGE TYPE: N-channel MOS. Memory housed in the processor cabinet uses 16K-bit chips; the new external memory uses 64K-bit chips.

CAPACITY: See Table 1.

CYCLE TIME: Read/write cycle time of 580 nanoseconds; 625 nanosecond access to corrected read data; and 928 nanosecond partial write cycle. Memory refresh takes 24 nanoseconds. Single and partial word writes are available. In multiprocessor systems, storage modules may be interleaved under control of the System Support Processor (SSP) software.

CHECKING: The Main Storage Unit (MSU) contains circuitry for single-bit error detection and correction and detection of double-bit errors. Multiples of double-bit errors and some odd multiples of double-bit errors are also detected. Memory errors are detected using a 7-bit hamming code generated for all read and write operations.

A parity bit with each half-word is checked whenever storage is referenced for I/O transfers via the two IOU interfaces. The MSU also detects single-bit address errors and out of bounds addresses.

STORAGE PROTECTION: The Bank Descriptor Registers (BDRs) loaded by the 1100 Operating System define the upper and lower boundaries of both the instruction areas and data areas that may be referenced by the currently active user program. Any attempt to reference an address beyond these

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TABLE 1. Sperry Univac 1100/60 System Summary

	No. of CPUs	Relative Performance	No. of IOUs	Extended Instruction Set	SIUs/Words Buffer Storage	Main Memory Capacity, Words	SSP/ Console
1100/61:							
B1	1	1.0	1	No	None	512K-1024K	1
C1	1	1.2	1	No	None	512K-4096K	1
C2	1	1.5	1	Yes	None	512K-4096K	1
E1	1	1.8	1	No	1/2K	512K-8192K	1
E2	1	2.1	1	Yes	1/2K	512K-8192K	1
H1	1	2.7	1	No	1/8K	512K-8192K	1
H2	1	3.2	1	Yes	1/8K	512K-8192K	1
1100/62:							
E1MP	2	3.4	2	No	2/4K	1024K-8192K	2
E2MP	2	4.1	2	Yes	2/4K	1024K-8192K	2
H1MP	2	5.1	2	No	2/16K	1024K-8192K	2
H2MP	2	6.2	2	Yes	2/16K	1024K-8192K	2
1100/63:							
H1MP	3	7.4	3	No	3/24K	1024K-8192K	2
H2MP	3	9.0	3	Yes	3/24K	1024K-8192K	2
1100/64:							
H1MP	4	9.7	4	No	4/32K	1024K-8192K	2
H2MP	4	11.6	4	Yes	4/32K	1024K-8192K	2

or 90/80 to an 1100/60 system. The AVP provides concurrent execution of applications written for the Series 90 operating system and applications written for the 1100 Series operating system.

PERIPHERALS AND COMMUNICATIONS

Mass storage equipment available for the 1100/60 system includes fixed-head drums, disk pack drives, and fixed-disk drives. Storage capacities range from 256,144 to 358,400,000 words. Also available is the Cache/Disk System, a hierarchical mass storage system that provides a level of memory between the 1100/60 CPU and 8450, 8470, or 8480 disk drives. (The 1100/61 Model B1 does not support the Cache/Disk System.)

Sperry Univac offers a variety of magnetic tape drives in both 7- and 9-track models, with data transfer rates ranging from 34,160 to 1,250,000 bytes per second. Also available are six line printer models with speeds ranging from 760 to 2000 lines per minute and a laser printer with a print speed of 10,500 to 21,000 lines per minute.

Data communications capabilities are strongly emphasized. The DCP/40 Communications Processor can handle from 16 to 156 communications lines and contains from 512K to 2048K bytes of memory. The DCP/40 can be used as a front-end processor, nodal processor, or remote concentrator, and is supported by Telcon software. The DCP/40 will handle data rates of 45 to 1.3 million bps as well as automatic answering and dialing. The DCP/40 supports UDLC, bisync, synchronous and asynchronous transmission.

The newer DCP/20 is a smaller version of the DCP/40. It supports 256K to 512K bytes of memory, 1 to 3 I/O processors, and up to 48 communications lines.

In addition to the DCPs, the 1100/60 also supports the older General Communications Subsystem (GCS) and the Communications Symbiont Processor (C/SP). The GCS supports communications networks of up to 32 half- or

limits causes a guard mode interrupt. The setting of a bit in the Designator Register determines whether the protection is against write operations; read, write, or jump operations; or whether no protection exists. In the first case, the operating system is in privileged mode. Under this mode, privileged programs such as real time programs or executive controlled subroutines may enter nonalterable (re-entrant) subroutines for reading or jumping only. In the second case, the operating system is in user mode. In the third case, the BDRs are loaded but ignored since the operating system is in OPEN mode. Registers BDRO and BDR1 correspond to I-bank (instruction word) address ranges and Registers BDR2 and BDR3 correspond to D-bank (data word or operand) address ranges.

RESERVED STORAGE: The low end of memory is reserved for storing the processor state during interrupts. The processor state consists of the program status, addressing status, and interrupt status. Interrupt routines and the general register stack are also located in the low end of memory.

BUFFER STORAGE (E and H models only)

STORAGE TYPE: IC semiconductor.

CAPACITY: 2048 words per CPU in E models, 8192 words per CPU in H models. Buffer storage is located in the Storage Interface Unit (SIU). A read request results in a serial retrieval of a four-word block from the MSU—the requested word and three adjacent words. Subsequent read references to the same or adjacent words in the block are presented at SIU speed with no further reference to the MSU required. The words in the buffer are divided into 512 sets. Each set contains four 4-word blocks. The SIU employs a paired least recently used (PLRU) algorithm to control aging and replacement of data blocks within each set. In case of buffer malfunction, the affected blocks are automatically bypassed.

CYCLE TIME: 116 nanoseconds per word.

CENTRAL PROCESSOR

All models of the 1100/60 employ the same basic 116 nanosecond CPU, which is a multi-microprocessor implementation of the 1100 Series architecture. The 1100/60 utilizes the Motorola 10800 as an LSI building block. The Motorola 10800 is a 4-bit slice with a 70 microinstruction repertoire using 10K ECL technology. The 1100/60 contains two microexecution units each composed of nine 10800 components. The two microexecution units concurrently

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full-duplex lines at up to 50,000 bits per second. The C/SP is a programmable front-end communications processor that can be used for message staging, audit trail preparation, and store-and-forward message switching applications. The C/SP supports up to 64 full-duplex or 128 half-duplex communications lines.

Sperry Univac's Distributed Communication Architecture, first announced in November 1976, continues to be a viable technology in the vendor's overall communications philosophy. Under the DCA concept, according to Sperry Univac, continued compatibility of present and future products will be ensured by specifying interfaces and functions of all components and providing guidelines for the building of communications networks. DCA can accommodate a broad range of host processors and terminal attachments, including other manufacturers' equipment. Adaptable to both simple and complex networks, DCA is said to permit the design of networks that fulfill many specialized requirements, such as maximum-security, ultra-resilient, and low-overhead systems.

SOFTWARE

The 1100 Operating System is the standard operating system for all members of the 1100 Series, and furnishes comprehensive supervisory and control facilities for three distinct modes of multiprogrammed operation: batch, interactive, and real-time (or communications). It provides virtually the full gamut of desirable operating facilities, including dynamic storage allocation, re-entrancy, multiprocessing, dynamic reconfiguration, automatic recovery, multi-level prioritization, and system optimization.

Software facilities that operate under the control of the 1100 Operating System include processors for the Cobol, Fortran, Algol, Basic, Pascal, PL/1, APL, RPG, and Assembly languages, plus a variety of utility routines and applications packages.

Sperry Univac, like most other mainframe manufacturers, places a strong marketing emphasis on data base and data communications software. The new Universal Data System (UDS) 1100 is a collection of programs designed to provide a single unified data management subsystem. UDS 1100 components include the UDS 1100 Control, Data Management System (DMS) 1100, Processor Common Input/Output System (PCIOS) 1100, Relational Data Management System (RDMS) 1100, Data Dictionary System (DDS) 1100, Define File Processor (DFP), Integrated Recovery Utility (IRU), and File Administration System (FAS).

Data communications software includes the Communications Management System (CMS) 1100, which provides the communications interface to a DCA-based DCP/Telcon network, and the Processor Common Communication System (PCCS), which enables applications programs to utilize the communications system.

execute parts of the same macroinstruction (see below). Complete execution of every microinstruction requires four cycles. Speed is enhanced by overlapping execution of microinstructions. To further increase performance, microprocessor functions are generated using a phantom branching technique in which one of two functions is selected for execution in each microprocessor, one cycle after microaddress selection.

The concept of availability, reliability, and maintainability (ARM) was an important consideration in the design of the 1100/60 processor, according to Sperry Univac. To implement ARM, Sperry Univac provided duplicates for the microinstruction units, executing the same function on the same data in the duplicate unit and comparing the results at the end of each cycle. Similarly, the shifter, logic function section, and control store address generator are also duplicated. The 1100/60 also includes a hardware instruction retry mechanism which allows the system to recover from most transient faults, transparent to the operating environment.

The hardware monitor feature enables an 1100/60 to collect system profile performance data on hardware and software. Sampling of data can be initiated by software or operator request. The signals are sampled every 475 microseconds and collected by the System Support Processor (SSP) every 30 seconds for storage in the system log for later report generation.

The 1100/60 processor also includes an interprocessor interrupt interface that allows operational control by the operating system to permit a CPU to interrupt another CPU or to be interrupted by another CPU in a multiprocessor environment.

CONTROL STORAGE: Consists of 2000 words where each word is 36-bits wide. Control storage has an access time of 50 nanoseconds.

REGISTERS: The 1100/60 processor contains a general register stack (GRS) that consists of 36-bit integrated circuit registers with a basic cycle time of 116 nanoseconds. The GRS includes 128 program addressable control registers with some overlap of function and some areas guard mode protected (e.g., the executive system of the operating system). The GRS includes an unassigned non-indexing register; 15 index registers; 4 registers that can be used for either indexing or accumulation; 16 accumulators; and the processor state control registers consisting of 2 pointer registers, the Executive Bank Descriptor Table Pointer and the User Bank Descriptor Table Pointer. There are 11 interrupt status words, including the Immediate Storage Check Designator Register and Guard Mode Designator Register, a quantum timer, Bank Descriptor Table Indexes, and jump history stack; 16 special registers, including the Real Time Clock (guard mode protected), Repeat Count Register, Mask Register, and user registers R3 through R15; 16 special guard mode protected executive registers, such as Executive Registers R0 and R3 through R15; Repeat Count Register and Mask Register; a guard mode protected (executive) non-indexing register; 15 executive index registers; 4 executive registers for indexing or accumulation; and 16 executive accumulators.

The Real Time Clock is initially loaded by the program and decremented once every 200 microseconds. The Repeat Count Register controls repeated operations such as block transfer and search instructions. The Mask Register is used with the search command in determining which portions of words are to be compared in repeated masked search operations. The Jump History Stack holds the recent 24-bit absolute addresses of jump instructions. The Quantum Timer, once loaded with an initial value, is decremented every

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The following end-user-oriented software systems are available to facilitate the development of transaction processing and management information systems: the Remote Processing System (RPS) 1100, a system that allows nonprogrammers to interactively develop and use their own file management applications from remote CRT terminals; Query Language Processor (QLP) 1100, an English-language batch or interactive interface to DMS 1100; Mapper 1100, a real-time report processing system; and ADVISE 1100, an application development tool.

The Interactive Processing Facility (IPF) consists of eight modules that provide a user interface to the 1100/60 system. IPF includes data management and distributed processing capabilities, security features, and terminal session control capabilities.

COMPATIBILITY

Within the 1100 Series, Sperry Univac has maintained a high degree of program and data compatibility. This has been continued with the 1100/60, both on the source and object level. There is no direct program compatibility, at the machine or assembly-language level, between the 1100 Series and any other line of Sperry Univac or competitive computers. The 1100 Series implementations of the Cobol, Fortran, Algol, Basic, PL/1, and Pascal languages, however, are generally in accordance with the accepted standards for these languages. The 1100 Series systems originally used the 6-bit Fieldata code, but in an effort to resolve the resulting compatibility problems, Sperry Univac has gradually revised most of the hardware and software to make use of ASCII. Thus, for most practical purposes, an 1100 Series computer can now be considered a byte-oriented ASCII machine.

COMPETITIVE POSITION

According to Sperry Univac, the entry-level 1100/61 Model B1 is equivalent in performance to the IBM 4331 Model Group 2. The 1100/60 C models compete with the IBM 4341 and Burroughs B 5900. The 1100/60 E and H models offer twice the memory capacity of the 4341 Model Groups 2 and 12. Multiprocessor 1100/60 systems compete with the Burroughs B 6900, the IBM 303X Series, and the Honeywell DPS 8 systems.

For relative performance levels within the 1100/60 family, please refer to Table 1.

USER REACTION

In Datapro's 1982 survey of general-purpose computer users, 27 Sperry Univac 1100/60 users reported on their experience with 30 systems. These systems had been installed for an average of 13.1 months.

The 27 survey respondents represented a wide variety of industries and organizations, including manufacturing (9 responses), government (3 responses), education (3 responses), and public utilities (3 responses). The primary

116 nanoseconds of actual CPU use, provided that a bit in the Designator Register is set. The Bank Descriptor Registers are described in the section entitled Storage Protection. The Designator Register generally determines functioning characteristics of the CPU.

The Breakpoint Register is employed with the address breakpoint mechanism. It allows an interrupt to be initiated when an equality comparison is made between the absolute address in the register or an operand address. The Breakpoint Register is operational on all instruction addresses, read/write references to main memory, and I/O references to main memory.

ADDRESSING: The 1100/60 has an address range of 16 million words. Both indirect and direct addressing are possible. Indirect addressing is possible to any desired number of levels, with full indexing capabilities at each level. Operand addresses can be modified by the contents of any of 19 index registers. If desired, the contents of the index register can be automatically incremented by any specific value each time the register is referenced.

INSTRUCTION REPERTOIRE: The 1100/60 has 161 standard instructions. To a great extent, the instruction repertoire is identical with that of the other 1100 Series systems in order to maintain compatibility. To utilize the full capabilities of the 1100/60 system, additional privileged instructions are included, and an optional Extended Instruction Set (EIS) is also available.

Most instructions specify the address of one operand in main storage and one of the accumulators. Complete binary arithmetic facilities are provided for single-precision fixed-point and both single and double-precision floating-point operands. Addition and subtraction can also be performed on double-precision fixed-point operands and on 18-bit half-words and 12-bit third-words. Also included are extensive facilities for testing, shifting, searching, and logical operations.

The instruction set is broken down as follows: 11 load instructions, 8 store instructions, 20 fixed-point arithmetic instructions, 16 floating-point arithmetic instructions, 14 repeated search instructions, 14 test or skip instructions, 12 shift instructions, 17 executive system control instructions, 29 jump instructions, 4 logical instructions, 11 miscellaneous instructions, 5 I/O instructions, and 20 optional EIS instructions.

EIS includes bit string instructions for moving, comparing, and translating character or byte fields; decimal arithmetic and edit instructions; and instructions for converting between ASCII, decimal and binary notation. Sperry Univac states that gains realized by the use of EIS can be expected to be in the range of 25 to 35 percent for heavy COBOL/DMS batch type environments.

INSTRUCTION TIMINGS: Sperry Univac states that instruction timings for the 1100/60 will be made available only to "qualified" users or consultants.

INTERRUPTS: A program interrupt facility causes storage of the current processor state in the three groupings of program status, address status, and interrupt status from the Processor State Register's contents and a transfer of control to the Operating System whenever one of the following conditions occurs: completion of an I/O operation, abnormal condition in an I/O subsystem, processor or storage fault, program error, or program-requested interrupt.

There are 24 priority level interrupts available in the 1100/60. Priority levels 0 through 10 are internal interrupts, which can neither be locked out nor deferred. The remainder are external interrupts which can be both locked out and deferred. All external interrupts are presented to each CPU in

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TABLE 2. Mass Storage

Subsystems	FH-432/ FH-1782 Drums	8407 Diskette	8430/8433 Disks	8434 Disk	8450 Disk	8470/8480 Disks
Cabinets per subsystem	1 to 8	1 or 2	2 to 32	1 to 16	2 to 32	2-32/1-8
Disk packs/HDAs per cabinet	—	1	1 removable	1 fixed	1 HDA	1 HDA/4 HDAs
Capacity:						
Bytes*	1.17M/9.4M	Up to 1.0M	77M/154M	243.8M	243.3M	403M/1612M
Words*	256K/2048K	—	17M/34M	54M	54M	89.6M/384.4M
Tracks/segments per drive unit	384/1536	77 to 154 per diskette	7,809/15,485	16,682	16,800	20,160/80,000
Average access time, milliseconds	4.3/17.0	175	27/30	30	23	23
Average rotational delay	—	83.3	8.3	8.3	8.3	8.3
Data transfer rate:						
Bytes/second	1,080,000	62,000 max.	806,000	1,257,000	1,260,000	2,097,000
Words/second	240,000	—	179,111	279,333	280,000	466,000
Controller model	5012-99	Integrated	5039	5046	5046	5056
Comments	Models FH-432 and FH-1782 can be intermixed on same system.	Available with manual or autoload; autoload accommodates up to 20 diskettes.	Can be intermixed with other 8400 series drives.	Can be intermixed with other 8400 series drives.	Fixed-head option available; can be intermixed with other 8400 Series drives.	Fixed-head option available for 8470; both models can be intermixed with other 8400 Series drives.

*Using 112-word records.

applications were accounting/billing (23 responses), payroll/personnel (17 responses), and order processing/inventory control (15 responses).

The users' ratings of the 1100/60 systems were as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	7	16	3	1	3.07
Reliability of mainframe	11	14	1	1	3.30
Reliability of peripherals	3	12	8	1	2.71
Maintenance service:					
Responsiveness	15	10	2	0	3.48
Effectiveness	7	13	6	1	2.96
Technical support:					
Trouble-shooting	5	14	8	0	2.89
Education	0	16	7	2	2.56
Documentation	0	12	10	5	2.26
Manufacturer's software:					
Operating system	11	13	1	2	3.22
Compilers & assemblers	7	19	1	0	3.22
Application programs	1	15	5	1	2.73
Ease of programming	5	16	5	0	3.00
Ease of conversion	3	14	5	4	2.62
Overall satisfaction	6	17	2	1	3.08

*Weighted Average on a scale of 4.0 for Excellent.

In November 1981, we contacted three of the survey respondents and asked them for further comments on their experience with the 1100/60 system.

The first user interviewed had installed an 1100/61 Model H1 in 1980 as a replacement for a Data General Eclipse. This user said he had rewritten many of the applications programs, but the "data conversion went smoothly." He summarized his opinion of the 1100/60 by saying, "I love it." He added that the system's main advantage was its reliability. His organization has more than 100 terminals used for travel reservations, and "even five minutes of downtime would be disastrous."

the system. Therefore, an interlocked synchronization mechanism is provided to ensure that only one CPU actually accepts the interrupt request.

PHYSICAL SPECIFICATIONS: The 1100/60 central complex cabinet is 30 inches deep, 78 inches wide, and 64 inches high. The cabinet weighs approximately 1500 pounds. Power requirements for the basic CPU complex cabinet is 7 KVA, 60 Hz. A motor alternator is not required. Cooling required by the CPU complex is less than 1500 cubic feet per minute forced air, supplied from room air or false floor. Sperry Univac quotes the heat dissipation as less than 24,000 BTU per hour. Recommended temperature for the typical system is 75 degrees F with a relative humidity of 50 percent noncondensing.

SYSTEM SUPPORT PROCESSOR (SSP): The 1100/60 SSP provides partitioning, system control, maintenance, and console management functions. The SSP is a stand-alone desk-sized unit that interfaces to the CPU complex and its component parts including the CPU, IOU, MSU, and SIU. A basic configuration for the SSP includes CRT/keyboard/printer console, 128K bytes of addressable storage, a console interface, diskette drive interface, remote maintenance interface, and central complex interface.

The partitioning function provides the ability to assign individual central-complex units of a system to either one of two independent smaller systems, or to isolate a unit from either application for off-line concurrent maintenance. Partitioning is supported via partitioning panel displays. The SSP also defines special system protection modes such as real-time and maintenance modes.

The partitioning function also indicates the operational status of each central-complex unit. These status conditions are available to system software for configuration control. The ability to control the partitioning of subsystems is also provided.

Two partitioning features are built into the IOU. One feature controls shared peripheral interface units on word channels, and the other controls the byte channel transfer switch for subsystems connected to a block multiplexer channel. The SSP provides control of system functions such as clocks and

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TABLE 3. Input/Output Units

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
Uniservo 22	9	800	NRZI	75	60,000
	9	1600	PE	75	120,000
Uniservo 24	9	800	NRZI	125	100,000
	9	1600	PE	125	200,000
Uniservo 30	7	200	NRZI	200	40,000
	7	556	NRZI	200	111,200
	7	800	NRZI	200	160,000
	9	800	NRZI	200	160,000
	9	1600	PE	200	320,000
Uniservo 32	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
Uniservo 34	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Uniservo 36	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size
0770-00	800 lpm	132	10	6 or 8	3.5 to 22 in. wide, 24 in. long
0770-02	1400 lpm	132	10	6 or 8	
0770-04	2000 lpm	132	10	6 or 8	
0776-00	760 lpm	136	10	6 or 8	4.0 to 18.75 in. wide, 24 in. long
0776-02	900 lpm	136	10	6 or 8	
0776-04	1200 lpm	136	10	6 or 8	
*0777 Laser Printer	10,500 to 21,000 lpm	136, 163, or 204	10, 12, or 15	6, 8, or 12	6.5 to 15.8 in. wide, 8 to 14 in. long

Card Equipment	Columns	Speed, Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
0716 Card Reader	80	1000	2400	2 2000-card stackers	51- or 66-col. cards, validity checks, translators
0604 Card Punch	80	250	1000	2 1000-card stackers	—

*Not supported on 1100/61 Model B1.

The second user represented a distributor that had installed an 1100/61 Model C2 in 1981 and had later upgraded to a Model H2. The 1100/60 system had replaced a Sperry Univac 90/30 system. The DP manager stated that he had encountered a "number of problems" during the conversion, because Sperry Univac's conversion team was "not familiar with the 1100 Series." However, he said that he is now satisfied with the system and that "uptime is 98 percent."

The third user interviewed had originally installed an 1100/61 Model H2, but added a second CPU in order to support the workload. This user said the 1100/60 hardware is "about as reliable as any," but the "software is a problem." He commented that he was using the system in a time-sharing environment and thought the 1100/60 was "weak in time-sharing." He added that he thought the system was "strong in transaction processing and is basically a batch-oriented system."

timers, stop jump control, initial load path, and auto recovery through system operator panel displays on the console. An optional System Performance Monitor (see Software) is also under SSP control.

The SSP acts as a primary maintenance tool through functions such as control storage loading, fault corrections, scan/set data comparisons, error logging, and a remote maintenance capability. One of the tools available to the SSP for maintenance is the Logic Analyzer, which provides a means of sampling and recording logic signals at discrete intervals of time. Not only does the SSP control the sampling rate, but also the starting/stopping of logic signal recording.

The SSP also acts as the communications link between the 1100/60 and the system console(s). The minimum system console consists of a Uniscope 200 Display Terminal with alphanumeric keyboard, 200-cps bidirectional printer, a control panel, and a stand. The CRT displays 16 lines of 64 characters each and uses a 7-bit ASCII character set. The System Console also includes a fault indicator, which indicates fault conditions in major system components, and

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Of the 27 respondents, 21 said they would recommend the 1100/60 to other users, three said they would not recommend it, and three were undecided.□

an interface for the Total Remote Assistance Center (TRACE) remote diagnostic capability.

ATTACHED VIRTUAL PROCESSOR (AVP): The 1100/60 AVP is a special-purpose processor that provides a migration path from the byte-oriented Series 90/60 and 90/80 systems to the word-oriented 1100/60 system. The 1100/60 AVP can be attached to any processor model in the 1100/60 family except Model B1. Performance is comparable to the 90/80-3. The AVP provides concurrent execution of applications written for the VS/9 operating system and applications written for the 1100 Series operating system.

The 1100/60 AVP incorporates system features found in both Series 90 and 1100/60 processors. On the VS/9 side, the hardware includes a CPU with a logic bus structure and microcode control similar to the Univac 90/80 family. In addition, the reliability features of the 90/80, such as parity checking, control store, and duplicate adders, have been maintained and applied to the AVP. The 1100/60 System Support Processor (SSP) is also included, and provides partitioning, system control, maintenance, and console management functions.

The system's main memory ranges from 512K (2 megabytes) to 1024K words (4 megabytes). An 8K-word (32K bytes) cache unit provides buffer storage of instructions and data between the 1100 Main Storage Unit (MSU) and the AVP CPU. The cache is designed to improve CPU performance while reducing the number of requests into the MSU.

I/O operations are handled by the 1100/60 AVP using a new software product, the Attached Processor Control Software (APCS). The 1100/60 AVP can accommodate VS/9 random access data files via direct, logical, or local attachment. The Direct Attachment feature permits disk subsystems of the Series 90 systems to attach directly to the 1100/60 block multiplexer channel. Files written for VS/9 can be run on the 1100/60 AVP without change. The Logical Attachment facility permits the VS/9 user to utilize current technology random access devices, such as the Univac 8470 disk drive, that are not included in standard VS/9 configurations. The third access mode, Local Attachment, permits devices available for VS/9 operation, but not for OS 1100, to be run on the 1100/60 AVP. The devices are attached to an optional block multiplexer channel.

Several VS/9 software products have been modified for use in the 1100 Series. These products are IMS 1100, based on the IMS/90 transaction processing system; the Interactive Processing Facility 1100; a full-screen display text editor called EDIT 1100; the Programmers Advanced Debugging System, PADS 1100; and an industry compatible RPG II compiler.

INPUT/OUTPUT CONTROL

I/O CHANNELS: All 1100/60 models contain one Input/Output Unit (IOU). The IOU consists of a central control module (CCM) and up to five or six channel modules. The CCM provides independent control paths to up to two CPUs and up to two SSPs and data paths to/from up to two MSUs and the channel modules. The CCM processes all I/O instructions, passes control information to the channel modules, controls main storage requests, updates control words and format status words, and generates all interrupt requests.

Each channel module consists of either one block multiplexer channel or four word channels. The basic IOU contains one word channel module and one block multiplexer channel. A fully configured IOU can consist of 2 block multiplexer channels and 12 word channels, 3 block multiplexer channels and 8 word channels, or 5 block multiplexer channels and 4 word channels.

Individual word channels operate in one of three modes: 36-bit Internally Specified Index (ISI), 18-bit Externally Specified Index (ESI), or 9-bit ESI. The ISI mode word channel has one subchannel assignment. The ESI mode word channel has up to 64 subchannels, while the block multiplexer channel has up to 128 subchannels for concurrent operation. Each IOU can support up to 1024 subchannels. One subchannel is reserved for the status table, leaving 1023 for use by the system.

The maximum block multiplexer channel data rate is 1.66 million bytes per second. The maximum word channel data rate is 0.60 million words per second in ISI mode. The aggregate output data rate for a word channel module (four channels) operating in ISI mode is 0.86 million words per second. The aggregate input data rate for a word channel module is 1.4 million words per second.

SIMULTANEOUS OPERATIONS: One input or output operation on each I/O channel can occur simultaneously with computation in each processor. Moreover, the Externally Specified Index (ESI) mode permits multiple remote communications devices to transmit data to and from main storage in multiplexed fashion over a single I/O channel. All installed processors and IOUs can operate simultaneously and independently, with interference occurring only when two or more of these units simultaneously attempt to access the same storage module.

The microinstruction execution units utilize overlap execution techniques, with one new microinstruction starting each cycle.

CONFIGURATION RULES

The 1100/61 Model B1 consists of the 1100/60 CPU with 512K words (2 megabytes) of main memory expandable to 1024K words (4 megabytes), one IOU with a second optional, one SSP, and one system console. Up to three additional system consoles can be configured.

The 1100/61 Model C1 consists of the 1100/60 CPU with 512K or 1024K words (2 or 4 megabytes) of main memory expandable to 4096K words (16 megabytes), one IOU with a second optional, one SSP, and one system console. Up to three additional consoles are optional. The additional consoles may be system consoles with printers or auxiliary consoles without printers. The 1100/61 Model C2 is the same as the C1 with the addition of the Extended Instruction Set (EIS).

The 1100/61 Model E1 consists of the 1100/60 CPU with 512K or 1024K words of main memory expandable to 8192K words (32 megabytes), one IOU with a second optional, one 2K-word (8K-byte) SIU, and one SSP. The console configuration is the same as for the 1100/61 Model C1. The 1100/61 Model E2 is the same as the E1 with the addition of the EIS.

The 1100/62 Model E1 consists of two 1100/61 Model E1 systems in a tightly coupled multiprocessor configuration. Similarly, the 1100/62 Model E2 consists of two 1100/61 Model E2 systems. The maximum main memory capacity of these systems is 8192K words—4096K words per processor. A maximum of five additional consoles is permitted in an 1100/62 Model E1 or E2 configuration. One auxiliary console, interfaced to both SSPs, is required as a maintenance console. The other additional consoles can be system consoles or auxiliary consoles.

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The 1100/61 Model H1 consists of the 1100/60 CPU with 512K or 1024K words of main memory expandable to 8192K words, one IOU with a second optional, one 8K-word (32K-byte) SIU, and an SSP. The console configuration is the same as for the 1100/61 Model C1. The 1100/61 Model H2 is the same as the H1 with the addition of the EIS.

The 1100/62 Model H1 is configured by adding an H1 Multiprocessor Upgrade to an 1100/61 Model H1 system. The upgrade includes a second H1 processing complex without main memory. Main memory can be expanded to 8192K words. The 1100/62 Model H2 is the same as the H1 with the addition of the EIS. The console configuration for the 1100/62 Model H1 or H2 is the same as for the 1100/62 Model E1 or E2.

The 1100/63 and 1100/64 Model H1 configurations consist of an 1100/62 Model H1 system plus two or three additional CPUs and SIUs. The 1100/63 and 1100/64 multiprocessor upgrades do not include main memory, an SSP, or a system console. Main memory can be expanded to a maximum of 8192K words, regardless of the number of CPUs. The 1100/63 or 1100/64 Model H2 configuration is the same as the H1 with the addition of the EIS. The console configuration for the 1100/63 and 1100/64 Model H1 or H2 is the same as for the 1100/62 Model E1 or E2.

On the 1100/61 Model B1, main memory is housed in the processor cabinet and is expandable in 256K-word increments. Main memory on the original 1100/60 systems was configured in the same manner. However, in November 1981, Sperry Univac introduced a new external memory storage cabinet with a capacity of 1024K to 4096K words, with expansion in 1024K-word increments. Two memory cabinets are required to house the maximum of 8192K words permitted on a Model E or H system. Various memory expansion features are available to expand the memory capacity of existing 1100/60 Model C, E, and H systems with less than 1024K words of memory. New customers can order an 1100/60 Model C, E, or H system with a minimum of 1024K words of memory housed in the external cabinet.

Minimum peripheral equipment required to complete a 1100/60 processing system includes an 0716 Card Reader Subsystem, an 0776 Printer Subsystem, an 8450 Disk Subsystem with one control unit and two 8450 Disk Drives, and a magnetic tape subsystem with one control unit and two Uniservo 22 or 24 Magnetic Tape Units.

As an alternative, a minimum peripheral system would include a communications subsystem with at least one input terminal, an 0770 Printer Subsystem, an 8430/8433/8434/8470 Disk Subsystem with one control unit and two 8430, 8433, 8434, or 8470 Disk Drives, and a magnetic tape subsystem with one control unit and two Uniservo 30, 32, 34, or 36 Magnetic Tape Units.

No maximum peripheral restrictions are placed on the 1100/60 configurations other than channel considerations (see Input/Output Control). However, some peripheral subsystems used on earlier Sperry Univac 1100 Series Systems can only be configured with present software support. Sperry Univac will not enhance any of the existing 1100 Series software for these subsystems.

MASS STORAGE

Disk and diskette subsystems supported on the 1100/60 are listed in Table 2.

CACHE/DISK SYSTEM: A hierarchical mass storage system that provides a level of memory between the 1100/60 processor and 8450, 8470, or 8480 disk drives. The Cache/Disk System consists of one or two 5057 Cache/Disk Processors, up to four 7053 Storage Units, and up to eight 8450, eight 8470, or two 8480 disk units (16 drives maximum). The Cache/Disk System is not supported by the 1100/61 Model B1.

The 5057 Cache/Disk Processor controls all data access functions including indexing, searching, buffering, storage management, staging and destaging of data to and from disk, and error recovery. The 7053 Storage Unit contains 917,504 words (4 megabytes) of semiconductor memory. It can be configured as cache memory, as a solid-state disk, or both.

In Cache/Disk mode, data is automatically transferred from the disk to the 7053 Storage Unit. The host computer accesses data as if it were stored on the disks. A separate indexing feature, the Segment Descriptor Table (SDT), is required in one of the 7053 units. The SDT contains a list of disk addresses that point to cache storage areas containing duplicates of data in recently referenced disk space. When an index find occurs, data transmission between the cache and the host CPU begins in about one millisecond. If an index miss occurs, the 5057 processor issues a seek to disk and disconnects for other activity.

In Solid-State Disk mode, the 7053 is directly addressed by the host processor. The access time in this mode is approximately 0.2 millisecond. In both Cache/Disk and Solid-State Disk modes, the response time is improved by eliminating the seek and latency time required by the disk drives.

In addition, the Cache/Disk System permits the use of larger disk record sizes, thus maximizing the capacity of disk storage. In Cache/Disk mode, data is transferred from the 8450 disk unit in segments of 448 words and from the 8470 and 8480 disk units in segments of 1792 words. Using the 448-word format, each 8450 stores up to 67 million words (302 million bytes). Each 8470 stores up to 143 million words (645 million bytes) using the 1792-word format. Using the same 1792-word format, the 8480 stores up to 573 million words (2580 million bytes).

INPUT/OUTPUT UNITS

Magnetic tape drives, printers, and punched card equipment for the 1100/60 are listed in Table 3.

COMMUNICATIONS CONTROL

DCP/TELCON: Telcon is an intelligent communications system that provides basic hardware, software, and peripherals for users with large communications networks. The system can operate as a front-end processor for 1100/60 and other 1100 Series host processors, as a network nodal processor, or as a remote concentrator. As such, it provides networks that support real-time, time-sharing, remote job entry, and message switching applications. The major components of Telcon are the Distributed Communications Processor (DCP) and the Telcon network software. Multiple DCPs can be combined to form a node of high throughput and processing capability.

The original DCP and the newer DCP/40 are independently operating communications processors designed to perform as front ends, remote concentrators/terminal controllers, stand-alone network nodes, or in a combination of these roles at the same time. The newer DCP/20, a smaller version of the DCP/40, can serve as a front-end processor or as a remote concentrator.

The DCP/20 system consists of a processor with 256K to 512K bytes of memory, one to three I/O processors, and communications line modules. The main processor performs both generalized communications processing and input/output processing; the I/O processors perform input/output processing only.

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The DCP/20 processor and each I/O processor provide programmed control for up to 16 data paths, which can be a combination of serial lines to remote equipment, channels to peripheral devices, or channels to on-site host Series 1100 or Series 90 processors. Each operational port on the I/O processors requires one line module, which provides an interface to a line and performs various communications functions such as control character recognition and line timing. DCP/20 accommodates asynchronous, synchronous, and wideband transmission at up to 64K bits per second. It supports Universal Data Link Control as well as character-oriented communications protocols.

The DCP/40 represents a significant increase in performance and throughput over the original DCP, primarily through the introduction of multiple microprocessors and microcoded message handlers.

Main memory ranges from a minimum of 512K to 2048K bytes, expandable in 512K-byte increments. A maximum DCP/40 may include up to 16 I/O processors, each of which provides program control for up to 16 communications channels. Each can handle a mixture of remote lines, parallel interfaces and host channel connections. Each I/O processor is programmed separately using a set of over 60 macroinstructions and each handles, in addition to data transmission and receipt, remote terminal polling, error checking and recovery, dynamic buffer allocation, reporting of line status, and recording of error and traffic statistics.

The increased memory permits larger and more complex user applications to be included in a single DCP. In addition, the DCP/40 may front-end either 1100 Series or 90 Series mainframes, and supports up to 256 half- or full-duplex communications lines.

The DCP/20 and DCP/40 are modular hardware systems that can be tailored to meet the needs of a broad range of users. The network software, Telcon, like the hardware, is also modularly structured and readily tailored by the user. A repertoire of over 285 instructions is available to the user for the generation, assembly and loading of message handling routines.

Terminal handlers in the DCPs, software and firmware, are available for most standard Sperry Univac terminal devices, as well as several non-Univac terminals including Teletype and IBM 3270 and 2780/3780 batch. Other software modules handle particular line protocols such as the UDLC trunk lines, or access links to/from X.25 packet switching services.

In addition to off-loading the host, the DCP lends a degree of network reliability and resiliency to the user. The standalone capability of a single network DCP may permit continued message acceptance and storage of data during periods of temporary inaccessibility to a given host or terminal. Similarly, multiple DCPs may be redundantly configured to maximize network uptime or increase network throughput.

GENERAL COMMUNICATION SUBSYSTEM (GCS): Announced in March 1975, the GCS replaced the earlier CTMC for all 1100 Series configurations. The GCS can accommodate up to 32 half- and/or full-duplex communications lines at speeds of up to 50,000 bits per second, under direct program control of the central processor. The GCS consists of a Communications Terminal Controller that connects to a processor ESI I/O channel and acts as a multiplexer to from 1 to 32 Communications Terminals and Communications Interfaces. However, the 1100/61 Model B1 processor supports a maximum of 16 high-speed Communications Terminals. Each Communications Terminal/Communications Interface combination can accommodate one half-duplex or one full-duplex line. Transmission is in asynchronous or synchronous bit-serial mode, using codes of 5, 6, 7, or 8 levels. The asynchronous interfaces can handle speeds ranging from 45.45 to 2400 bits per second, while the synchronous interface can handle line speeds of up to 50,000 bits per second. In addition to the bit-serial interfaces, an automatic dial interface is available.

TERMINALS: The following Sperry Univac devices, most of which are described elsewhere in DATAPRO 70, are supported for use as remote terminals with the 1100 Series systems: the Uniscope 100 and Uniscope 200 (Report 70D2-010-15), and the UTS 400 (Report 70D1-877-01). Support for IBM's binary synchronous communications protocol also permits transfer of data between IBM System/360 and System/370 and Sperry Univac 1100 Series systems and the use of some IBM-compatible remote batch terminals.

SOFTWARE

OPERATING SYSTEM: All 1100 Series systems utilize the 1100 Operating System, which supports batch, transaction, real-time, and interactive processing in multiprogramming, multiprocessing, and distributed processing environments. The heart of the 1100 Operating System is the Executive, which supports user program processing.

Batch processing jobs can be submitted either locally or remotely. A scheduling routine selects the runs to be initiated in accordance with user-assigned priorities and deadlines.

The demand processing facilities of the 1100 Operating System permit interactive use of the system by multiple users at remote terminals. By means of the Executive Control Language, demand-mode users can compile and execute programs, use library facilities, and communicate with the computer center and with other terminals. (More comprehensive facilities for interactive operations are provided by the Interactive Processing Facility, Conversational Time-Sharing, and High-Volume Time-Sharing systems, described later in this report.)

Real-time and communications programs, which are subject to specific time constraints, receive top-priority handling by the 1100 Operating System. Real-time programs receive privileged access to system resources such as central processors, memory, and input/output channels, and have a priority higher than any other processing except for Executive interrupt processing. Interrupt processing routines can be defined for each real-time communications line; they execute at a higher priority than all other processing. Communications control facilities for transaction processing are provided by the Communications Management System and the Transaction Interface Package, described later in this report.

Multiprocessing is handled as a logical extension of the 1100 Executive's multiprogramming capabilities. The system maintains a list of processor activities currently waiting to be performed. Each processor inspects this list, selects a task, and executes it. One processor can interlock the others while referencing critical areas of common data, and various other techniques are employed to guard against inter-processor interference.

A number of *system management tools* are available for Executive system management, upgrading, and testing. These include the Customer On-site Maintenance and Installation System (COMUS), the Quota system, and Fault Location by Interpretive Testing (FLIT).

The Customer On-Site Maintenance and Installation Subsystem (COMUS) facilitates the installation and maintenance of the Executive software and program products. COMUS provides a high-level interface that directs an automatic system generation process. Augmenting COMUS is the Symbolic Stream generator (SSG). Directions

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and models for building the desired stream images are conveyed to SSG through a skeleton program. The resulting symbolic output streams can be placed in a user-specified file, printed, and dynamically added for execution after SSG terminates. SSG also helps to maintain symbolic input files that may be printed, corrected, and updated for later use.

The Quota System enables 1100 Series installations to control the use of system resources by both batch and demand users. The Quota Input Processor (QUIP) can be used by each installation to establish account and individual limits through user identification codes for use of system resources. With the Quota System, installations can prevent users from requesting the use of system resources beyond an account budget or a preassigned limit, control the number of concurrent demand and batch runs executing in the system, and define limits to be applied to resources available to demand and/or batch jobs at specified times.

Fault Location by Interpretive Testing (FLIT) provides the capability to execute and diagnose the Executive while running as a normal user program under Executive control. Thus, a new version of the Executive or a planned new configuration can be studied and tested in a "virtual" environment prior to its use as the production Executive system.

In addition, the 1100 Executive can dynamically monitor its own activity. The Software Instrumentation Package (SIP) provides a tool for system throughput and response optimization.

A number of *system processors* are also available, including The Terminal Security System (TSS), Sentry, Checkpoint/Restart, Memory Allocation Processor, Post-Mortem Dump Processor (PMD), Element Processor (ELT), Procedure Definition Processor (PDP), File and Program Utility Processor (FURPUR), and Data Processor.

The Terminal Security System (TSS) permits each installation to establish a file of valid remote system users through the use of user identification codes, passwords, and other pertinent information. The system allows installation passwords to be changed dynamically, and enables users to be selected as masters or submasters to allow delegation of authority in creating and updating identifications and passwords in the TSS file. Each installation can define the action to be taken in the event of an attempted security violation.

Sentry is a security control processor that is used to create and maintain a user security profile database, which is then used to control user access to files and certain privileged functions. Checkpoint/Restart snapshots a run or program and creates a checkpoint that may be used for restarting at a later time if desired. The Memory Allocation Processor provides for the collection and interconnection of relocatable elements produced by the compilers to produce an executable program. The Postmortem Dump Processor is a user debugging aid that produces edited dumps of the contents of main storage if the program terminates abnormally. Optionally, a dump can be produced when a program terminates normally.

The Element Processor is used to insert symbolic, relocatable, absolute, or omnibus elements into a program file from images in the runstream. The Procedure Definition Processor processes symbolic elements that may contain Assembler, Fortran, or Cobol procedures and produces entries in the table of contents of a program file. The File and Program Utility Processor consists of a set of file maintenance routines that provide for the management and manipulation of cataloged or temporary files containing data or programs. Finally, the Data Processor provides data handling capabilities at the file level.

COMMUNICATIONS PROCESSING: The 1100 Operating System supports two communications processing packages, the Communications Management System (CMS 1100) and the Processor Common Communication System (PCCS 1100), as well as the Distributed Communications Architecture (DCA).

The *Communications Management System* is the communications network interface for the 1100/60 system to a DCA-based DCP/Telcon network or to the General Communications Subsystem. It has been separated from the 1100 system generation process, thus allowing the entire terminal network configuration to be generated, checked, and corrected without generating a full system. CMS has cognizance of all terminals in an 1100 Series computer network. It acts as the communications "front-end" to the Transaction Interface Package (TIP), and handles polling, parity checking, data blocking, data packing and unpacking, message envelope formatting, message acknowledgement, message queuing, and other message control procedures. The message queue can be maintained in main and/or auxiliary storage; this common data pool is then accessed by the Transaction Interface Package. A Protocol function determines what the current activity on each circuit should be in terms of overall system loading, availability of facilities, user-specified priorities, type of circuit or device, and activity response level from the terminal.

CMS handles the standard Sperry Univac terminals as well as "alien" terminal devices. For alien devices the user must supply a skeletal communications control routine which interfaces into the device-control master service routine of CMS.

The *Processor Common Communication System* provides a means by which application programs developed in high-level languages such as Cobol and PL/1 can utilize the Series 1100 communications system. Programs using PCCS 1100 can communicate with other communication programs, terminal users, remote batch systems, and certain host computers.

The Distributed Communications Architecture (DCA) describes the currently-available communications hardware and software components through which networking of Univac processors and terminal devices is achieved.

Whether network control is host-dependent or host-independent, there are still certain hardware components and subsystems required to implement a DCA network. Inherently, a DCA node or host must contain several software components which provide it with the network interface. These components are detailed in this report.

The capability of completely separating communications management from applications processing is a key characteristic of DCA. The off-loading of communications processing permits the host, or hosts, to concentrate their energies on applications processing, their primary function.

In fact, in a DCA network, the host may (from a communications point of view) be required only to compile user programs for network management. Support programs would reside in the host for this purpose, and after compilation, object code would be loaded directly into channel-attached front ends or written to storage media for later loading into remote communications nodes. The host would then be free of communications and network control activities.

It is noteworthy that Sperry Univac offers an extensive library of modular network management applications. User programming for tailored communications functions (such as message switching) is also fully supported.

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A feature which serves to distinguish DCA from the architectural offerings of other major vendors is the facile acceptance into the DCA environment of non-Univac terminals, processors and networks, and the flexible modularity of the existing Sperry Univac communications hardware and software.

A minimal DCA network requires a DCA host with a communications subsystem. The host may be either an 1100 mainframe running under the 1100 operating system, or a 90 Series CPU, Model 60 or 80, running the VS/9 operating system.

A DCA terminal is generally one for which a standard terminal handling module is available from Sperry Univac. In DCA, each terminal might be operating with different character codes (ASCII, EBCDIC), transmission modes (start/stop asynchronous, character synchronous), or terminal protocols (U100, IBM 2780). It is the responsibility of the DCP closest to the terminal to translate its data format into a common trunk language—typically UDLC.

UDLC is a bit-oriented, syncrhonous protocol designed for full-duplex operation. Devices connected by UDLC trunks can utilize either switched or non-switched, voice-grade or digital lines. UDLC, like its SDLC, HDLC and ADCCP predecessors, uses bit sequences for control codes rather than whole characters. (Hence the nomenclature "bit-oriented.") This characteristic permits much more control information to be contained in the same or smaller amount of message space.

DATA MANAGEMENT: The *Universal Data System* (UDS 1100) is a collection of programs designed to provide 1100 Series users with a single unified data subsystem that furnishes the data management services for all components of the 1100 Operating System. UDS 1100 components include the UDS 1100 Control, Data Management System (DMS 1100), Processor Common Input/Output System (PCIOS), Relational Data Management System (RDMS 1100), Data Dictionary System (DDS 1100), Define File Processor (DFP), Integrated Recovery Utility (IRU), and File Administration System (FAS).

The *UDS 1100 Control* is the on-line data manager of the UDS system, which provides a complete range of data structures, utility programs, and support programs. UDS 1100 Control integrates these different programs and manages the movement of data between data models. The control module allows file sharing through a locking mechanism and allows the same program to access several data models. It also centralizes functions such as audit trails and administration.

DMS 1100 is a comprehensive database management system developed under the guiding principles of the CODASYL Data Base Task Group. It is designed to satisfy the need for standardized data management techniques that provide: 1) separation of the data definition and data manipulation functions, 2) an acceptable degree of data independence, 3) database protection and integrity, and 4) alternate data access methods. DMS has four principal components: a Data Description Language, a Data Manipulation Language, a Data Management Routine, and a Data Recognition Utility.

The Data Description Language is a standalone language whose record descriptions are compatible with those of Cobol. The Data Manipulation Language consists of commands embedded in Cobol, Fortran, and PL/1 to allow these host languages to manipulate the database via DMS 1100. The Data Management Routine, the key operational component of DMS 1100, maintains the database and preserves its integrity. The Data Reorganization Utility provides for optimization of the physical placement of records within an existing database without the need for tailored unload and reload programs. (For further information on DMS 1100, please refer to Report 70E-877-02 in Volume 3.)

PCIOS is designed to assure compatible data file formats. It supports sequential, indexed sequential, and multi-keyed sequential access methods for APL, PL/1, ASCII Cobol, ASCII Fortran, RPG, Sort, and QLP.

RDMS 1100 provides definition and access for both host language programming and end-user interface software. Relational databases are defined by the data manipulation language used for retrieval and updating of data. The Relational Transformation Language provides relational views of other databases, such as DMS 1100.

DDS 1100 provides a means for the centralized description, location, and control of the various elements within a user database environment. DDS 1100 consists of a database of information, called the meta-database, about the entities in the user database environment, as well as a set of processors that access the meta-database for the purpose of creating, updating, and reporting information.

The Define File Processor provides a data file description external to the program processing the file. Using DFP, programs written in Fortran, Cobol, PL/1, APL, and RPG are file-format-independent and can share common files.

The *Integrated Recovery Utility* provides the user with English-language commands to initiate a variety of integrity features and capabilities. IRU can be used to control user access to selected TIP or TIP/DMS files or to provide partial file access. It can also be used to compare complete or partial records between files.

The *File Acquisition System* is a functional successor to Sperry Univac's file administration processor, SECURE. FAS provides extensive file handling and control within an Interactive Processing Facility system environment. FAS includes capabilities for mass storage file backup, archiving, and reporting. It also provides for the administration of hierarchical files and directories.

TRANSACTION PROCESSING: The following programs provide transaction processing capabilities for 1100 Series systems: The Transaction Interface Package (TIP), Information Management System (IMS 1100), and Display Processing System (DPS 1100).

TIP serves as the "middleman" between the 1100 Operating System and the user's application programs in a transaction-oriented on-line data processing system. TIP's functions are stimulated by the incoming transaction messages stored in the common data pool maintained by CMS. The TIP transaction scanner, TRANSCAN, analyzes each message, determines which application program is required to process it, and arranges for the Executive to load and execute that program. One application program can also call another application program via TIP, through program action based on data parameters. The application programs can be written in Cobol, Fortran, Assembly Language, or PL/1 and can be re-entrant. TIP's features include on-line debugging aids, a batch-mode checkout capability, interprogram protection facilities, and comprehensive system recovery provisions. User-written routines can be accommodated by TIP to perform installation-specified functions such as prioritizing messages and other special message manipulation.

IMS 1100 is an interactive transaction processing system compatible with the IMS 90 used on the Sperry Univac 90 Series computers. It provides defined record management and access to both data and conventional files.

DPS 1100 provides for screen handling and the management of display-oriented transactions in an on-line environment.

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The system operates in conjunction with the Transaction Interface Package or the Conversational Time-Sharing System. DPS 1100 includes an interactive screen generator and a screen handler. Additional functions are provided for data editing and validation, applying passwords to screens or separate fields of screens, and controlling access to multi-page screens.

END-USER SYSTEMS: The following software products are specifically designed for end users: Mapper 1100, Advanced Information Service (ADVISE 1100), Query Language Processor (QLP 1100), and Remote Processing System (RPS 1100).

Mapper 1100 is a real-time report processing system for multiple Uniscope 100/200 or UTS 400/4000 terminal systems. Data is collected and updated via the CRT display units in free-form or prescribed report formats. Functions such as record and page display, update, search, sort, and report generation can be developed into saved programs for on-line application development. A forms generation capability allows implementation of databases and related report processing and generating services without applications programming.

ADVISE 1100 provides a set of easy-to-use tools for data definition, data interaction, and application development. ADVISE 1100 furnishes the query, update, and application development interface to RDMS 1100, so that users can design and access relational databases.

QLP 1100 is an English-language inquiry system that allows inquiries to be made to databases generated under DMS 1100. QLP 1100 has the ability to access standard data files and incorporates extended reporting capabilities. It uses a command language designed around a simplified English syntax and requires a minimum knowledge of the DMS 1100 database structure. QLP can operate either in demand or batch mode, although the primary mode is interactive. Its two major component modules, the Scan Parser, which analyzes incoming commands, and the Task Translator, which accesses the database, are both re-entrant. Through the use of the QLP command languages, users can inquire into the database, update records, add new records, or delete records. QLP 1100 uses a Subschema Data Definition Language (QLPSDDL) that is similar to the DMS 1100 DDL. Access to the database via QLP is regulated by the Data Base Administrator through use of SDDL. QLP also provides a report writer and procedural facilities.

The *Remote Processing System* is an interactive data management and file processing system that provides access to system resources by a nonprogramming-oriented user interface through a Uniscope 100 or Uniscope 200 CRT display terminal. RPS 1100 database files are created and maintained under DMS 1100, and the system interfaces with TIP for transaction interfacing and control. RPS 1100 provides a set of generalized system functions which can be invoked by the user via the terminal. These include commands to ENTER, BUILD, DESTROY, or FORM a file; to process a file through SEARCH, MATCH, or SORT; to build an INDEX structure to line item data and data fields for faster access; to perform computations on specified fields; and to request printing of reports in user-specified formats. RPS 1100 provides tutorial assistance to end users by displaying a choice of functions for user selection and utilizing "fill in the blanks" techniques to permit users to enter commands.

INTERACTIVE PROCESSING: Several software programs are available for interactive processing, including the Conversational Time-Sharing System (CTS 1100), High-Volume Time-Sharing (HVTS), and Interactive Processing Facility (IPF).

CTS 1100 is a modular software system that provides users at remote terminals with an efficient human-machine interface. The system consists of the CTS Control module, interactive syntax analyzers for Basic, Fortran, Cobol; and access to the compilers for Basic, Fortran, Cobol, Algol, and APL. CTS provides the user with a simplified command language editor.

The design of CTS is particularly oriented toward facilitating the development and debugging of programs. CTS facilities enable users to: 1) enter and debug source programs in line-by-line fashion; 2) compile programs; 3) edit source programs and data; 4) collect and execute programs; 5) save programs and data; 6) retrieve saved programs and data; 7) create files; 8) access the DMS data base; 9) format the output of data; 10) scan files and produce selective printouts; 11) write interactive procedures in CTS control language; and 12) perform calculations in desk calculator mode.

CTS has effectively been superseded by the newer Interactive Processing Facility, which is described below.

HVTS is an alternative to CTS that looks to the end user like a subset of CTS. It has the ability to handle 50 to 2000 active terminals concurrently. Each terminal can be active in one of six modes: APL, Basic, and Fortran language modes; a data mode; master mode; and monitor mode. A quota set regulates each terminal user, restricting use by time of day, maximum CPU usage, maximum program size, maximum data size, maximum program execution time, and language mode selection.

The *Interactive Processing Facility* supports both batch and time-sharing operations. It provides a user interface to the system through a procedural command language and an English-language response language. IPF 1100 is designed for ease of use by users with little or no data processing background as well as by computer professionals. Functional capabilities can be expanded by adding user-developed program modules or by modifying or adding commands. IPF 1100 includes data management capabilities, security features, and session control capabilities.

IPF consists of eight separately priced modules. The IPF Command Language is the primary interface for using IPF. It is based on CODASYL specifications. The development of command language subroutines and macros is accomplished through the use of the IPF Procedures module. The Distributed Data Processing module supports file transfers and job submissions from 1100 Series to 1100 Series systems. The Edit 1100 module is an input and update editor that provides access to a variety of file formats, works in an easy-to-use full-screen mode, and can be used from a terminal or called from a program. The User Assistance module manages both responses to the terminal user and HELP and explanation processing.

LANGUAGE PROCESSORS: The 1100 Series computers support a number of programming languages, which are described in the following paragraphs.

The *ASCII Cobol* compiler implements the modules of the 1974 American National Standard Cobol. Numerous extensions are also included. The ASCII Cobol compiler is re-entrant and produces re-entrant code.

ASCII Cobol recognizes ASCII characters as the standard data code at both source and object time, with 6-bit Fieldata character code handling facilities available as an option. In addition to the character modes, binary and floating-point data forms are supported. Some of the 1974 American National Standard Cobol facilities implemented include: Debugging, Report Writer, Communications (via TIP or Message Control System), and the INSPECT, STRING, and UNSTRING verbs. Principal language extensions based on CODASYL development efforts include: database manage-

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ment (via DMS), interprogram communication, and asynchronous processing. Additional nonstandard extensions include: debugging features (including MONITOR and EXHIBIT), a TRANSFORM verb to develop one character string from another, expanded forms control facilities including 160-character print line and variable print density control, indexed sequential file handling including generic START and conditional START facilities, and numerous compatibility features for upgrading from earlier 1100 Cobols or other vendors' Cobols.

Sperry Univac also offers a conversational Cobol Processor (BCOB) that permits time-sharing users to construct, edit, and debug Cobol programs from demand terminals. BCOB executes as a full re-entrant submodule of the Conversational Time-Sharing System (CTS) and supports the full CRT command set. Its syntax analysis facilities are compatible with both ASCII Cobol and an earlier Fieldata Cobol compiler. Syntax analysis is performed either statement-by-statement as the program is entered from the terminal or in blocks as the program is called from the file system.

ASCII Fortran is a re-entrant Fortran compiler that handles ASCII data codes and contains useful extensions for the manipulation of both numeric and non-numeric data. The ASCII Fortran language is an extension of the previous Sperry Univac Fortran V language and implements the Fortran 77 Standard. It contains features specified by the standard as well as many language extensions, including the following ASCII extensions. A CHARACTER type statement allows handling of character variables, character scalars, and character arrays. A set of character operations is provided, including concatenation of strings, relational comparisons of strings, character-valued functions, and a string function that permits character variables to be extracted from or assigned to substrings of character variables. ASCII Fortran provides the double-precision complex data type, in which complex numbers are represented internally as a pair of double-precision floating-point numbers. This data type supports a precision of approximately 17 significant decimal digits and an exponent range of 10^{-308} to 10^{308} for both real and imaginary components of a complex number. ASCII Fortran also expands the use of expressions by permitting expressions to be used in positions that previously (in Fortran V only) allowed simple variables or array elements.

ASCII Fortran is a four-pass, re-entrant, common-banked compiler that provides for extensive optimization, generates re-entrant programs, and contains facilities designed to fully utilize 1100 Series hardware features and the operating system. Some of the features are I/O data format compatibility, interlanguage communication with Cobol and PL/1, sort/merge capability, and an interface with DMS 1100. In addition, the ASCII Fortran compiler contains a checkout option that provides for direct execution of Fortran programs and subroutines, with interactive debugging also provided.

Sperry Univac also offers a re-entrant ASCII Fortran Syntax Analyzer (BFTN), which is used in conjunction with the Conversational Time-Sharing software. BFTN aids the time-sharing user in constructing, editing, and debugging the syntax of ASCII Fortran programs from a demand terminal.

APL 1100 is a re-entrant, interpretive processor that uses 9-bit ASCII code and functions as part of the Conversational Time-Sharing System. APL 1100 provides a superset of the ad hoc industry-standard APL language. It provides all the language features of the Iverson notation and offers extended capabilities in the areas of I/O operations and operating system related functions.

Pascal 1100 is based on the specifications of the American National Standard X3J9. Pascal 1100 facilitates the use of structured programming techniques for general programming problems through the use of the following control constructs: IF-THEN-ELSE, WHILE-DO, REPEAT-UNTIL, FOR-DO, and CASE. Pascal 1100 also includes data structuring facilities such as arrays, record structures, and file structures.

Sperry Univac's *NU Algol* language is based upon Algol 60, extended through the provision of input/output logic, facilities for complex and double-precision arithmetic, and the ability to name strings. Procedures written in Fortran V or Assembler language can be included. The Algol compiler runs under 1100 Operating System control.

Sperry Univac's *Basic compiler* is an interactive processor that accepts source-language statements from remote users, checks their syntax, and issues diagnostics immediately whenever it detects an error. After the whole program has been checked, a RUN command causes it to be compiled and executed. A file controller package permits manipulation of saved program files, and re-entrant capability enables multiple time-sharing terminals to use the compiler simultaneously. The system need not be dedicated exclusively to Basic operations.

The *1100 Series PL/1* compiler is Sperry Univac's implementation of the multipurpose programming language which has been proposed for standardization by ANSI and the European Computer Manufacturers Association (ECMA). Compilations can be performed with or without optimization. An extensive library of re-entrant run-time support routines complements the re-entrant code generated by the compiler with arithmetic computations, service subroutines such as input/output functions, dynamic program and storage management, and error and interrupt processing.

The *1100 Series RPG* is upward-compatible with Sperry Univac Series 70 RPG. It supports sequential, indexed sequential, and table files and provides common report-writing features such as input data selection, editing, calculation, multiple report files, summarizing, control breaks, and file updating. During program generation, storage areas are automatically assigned, constant factors are included, and linkages are produced to routines for input/output operations and calculations. Indexed sequential files are processed through an interface with the Index Sequential File Management System (ISFMS).

The *RPG II Group* is a software package that includes an RPG II compiler, auto report feature, and RPG II editor. The compiler is compatible with the Sperry Univac VS/9 and OS/3 operating systems used on the Series 90 computers.

MACRO is a general-purpose processor for extending host languages through its ability to process character strings. MACRO performs text generation, editing, and validation.

The 1100 Series *Meta-Assembler (MASM)* is capable of generating code for any binary machine, but is tailored to be especially efficient for the 1100 Series instruction set. MASM provides all the conventional features of an assembler: code and data generation, symbol definition, space definition, and external communication with separately constructed elements.

In addition to the language processors described above, Sperry Univac also offers the *Programmers Advanced Debugging System* (PADS 1100), a language-independent debugging tool. PADS was designed primarily for debugging programs written in high-level languages such as Cobol, Fortran, and PL/1, but it may also be used for programs written in Assembler.

UTILITIES: The 1100 Operating System supports a number of utility packages, including CULL, Sort/Merge, Log

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Analyzer, Performance Analysis Routines, and the On-Line System Activity Monitor.

CULL produces an alphabetically sorted, cross-referenced listing of all symbols in a specified set of symbolic elements. Each symbol processed by CULL can contain up to 12 alphanumeric characters plus the dollar sign. An interactive version, IACULL, is also available.

The *Sort/Merge* package provides three sort options and a standard merge option. The sort options are record sort, selection sort, and tag sort. Up to 26 files can be merged, and up to 40 keys can be specified.

The *Log Analyzer* (LA) is designed to assist the user in monitoring the resource utilization of an 1100 Series system. The *Performance Analysis Routines* (PAR) package is a reporting system for data collected by the Software Instrumentation Package embedded in the operating system. The *On-Line System Activity Monitor* (OSAM) provides an on-line, real-time display of system activity. OSAM can be used in conjunction with LA and PAR.

APPLICATION PROGRAMS: The 1100 series application packages currently available from Sperry Univac include:

APT (Automatically Programmed Tools)
ASET (Author System for Education and Training)
FMPS (Functional Mathematical Programming System)
GIFTS (Graphics-Oriented Interactive Finite-Element Time-Sharing System)
ICES (Integrated Civil Engineering System)
OPTIMA 1100 (Project Management System)
SUFICS 1100 (Sperry Univac Financial Integrated Control System)
UNIDAS 1100 (Information Storage and Retrieval)
UNIFACS 1100 (Univac Financial Systems)
UNIS 1100 (Univac Industrial Systems); includes Bill of Materials Processor, Inventory Control, and Planning and Scheduling
USAS (Univac Standard Airline System)

PRICING

The 1100/60 is available for purchase or on a one-year or five-year lease. All software except the operating system is unbundled. On-site service for operating system support can be obtained for a flat monthly fee. Sperry Univac also offers a 7-year lease to state and local governments and to educational institutions. Educational institutions are eligible for an additional 10 percent discount. The discount does not apply to maintenance service charges.

CONTRACT TERMS: The standard Sperry Univac use and service agreements allow unlimited use of the equipment (exclusive of the time required for remedial and preventive maintenance). There are no extra-use charges. The basic maintenance charge covers maintenance of the equipment for nine consecutive hours a day between the hours of 7 a.m. and 6 p.m., Monday through Friday. Extended periods of maintenance are available at premium rates. The premiums for additional coverage are a percentage of the base maintenance rate and are as follows:

	Hours of Coverage								
	4	8	9	10	12	16	18	20	24
Monday through Friday	—	—	100	105	110	115	120	125	130
Saturday	5	8	9	—	11	12	—	14	15
Sunday and Holidays	7	10	12	—	14	16	—	18	20

Maintenance service performed outside the contracted maintenance period is subject to the following rates:

	Monday through Friday	Saturday, Sunday and Holidays
Min. charge per call	$264	$300
Each addl. hour	132	150

Users who elect not to contract for maintenance with Sperry Univac pay the same rates on a per call basis.

TRACE: Sperry Univac has initiated a remote hardware maintenance concept through its facility in Roseville, Minnesota. The Total Remote Assistance Center (TRACE) is available to 1100/60 system customers via a dedicated WATS number 24 hours per day and seven days per week. Via TRACE, a user's system may be monitored and controlled using on-site and remote library testing programs. TRACE also provides support for a wide range of Sperry Univac terminals connected to dial up lines. Various data files in Roseville contain information on approved hardware changes, references to solutions for problems encountered with diagnostic test software in field use, and operating system enhancements and problems. Other files contain a history of how the system should operate properly, and can be utilized for comparison purposes during diagnostic testing.

EQUIPMENT: The following systems illustrate some of the configurations that are possible within the Sperry Univac 1100/60 Systems. All use the 1100 Operating System. All necessary control units and adapters are included in the indicated prices. Quoted lease prices do not include equipment maintenance charges.

1100/61 MODEL B1 SYSTEM: Includes CPU with 512K words of main memory, System Support Processor, System Console, Maintenance Console, I/O Unit with one block multiplexer channel and one word channel module, two 8450 Fixed-Disk Drives with controller, two Uniservo 22 Magnetic Tape Drives with controller, a 1200-lpm 0776 Printer, and an 0176-89 Card Reader. Purchase price is $549,883.

1100/62 E2 MULTIPROCESSOR SYSTEM: Includes two CPUs and two 2K-word buffers, one external Memory Storage Unit with 2048K words of main memory, two System Support Processors, two System Consoles, one Maintenance Console, two I/O Units with one block multiplexer channel and one word channel module each, four 8450 Fixed-Disk Drives with controller, six Uniservo 32 Magnetic Tape Drives with controller, two 1200-lpm 0776 Printers, and one 0176-89 Card Reader. Purchase price is $1,767,815 and the monthly charge on a one-year lease is $45,804.

1100/64 H2 MULTIPROCESSOR SYSTEM: Includes four CPUs and four 8K-word buffers, two external Memory Storage Units with a total of 8192K words of main memory, two System Support Processors, two System Consoles, two Auxiliary Consoles, one Maintenance Console, four I/O Units with one multiplexer channel and one word channel module each, eight 8470 Fixed-Disk Drives with two controllers, eight Uniservo 36 Magnetic Tape Drives with controller, and two 2000-lpm 0770 Printers. Purchase price is $4,393,411 and the monthly charge on a one-year lease is $110,822.

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
PROCESSORS					
3042-23	1100/61 Model B1 Standard Processing Complex; includes CPU with standard instruction set and 512K words of main memory, an IOU with one block multiplexer and one 4-word word channel module, a System Support Processor (SSP), and a system console with printer (limited availability)	$ 236,519	$1,000	$ —	$ 4,463
3072-23	1100/61 Model B1 Standard Processing Complex; same as 3042-23 but supports IOU Expansion F3751-00	236,519	1,000	—	4,463
3042-99	1100/61 Model C1 Standard Processing Complex; includes CPU with standard instruction set and 512K words of main memory, an IOU with one block multiplexer and one 4-word word channel module, a System Support Processor (SSP), and a system console with printer	336,519	1,342	8,007	6,346
3042-96	1100/61 Model C2 Standard Processing Complex; same as 3042-99 but with Extended Instruction Set	375,100	1,458	8,925	7,074
3062-99	1100/61 Model C1 Standard Processing Complex; same as 3042-99 but with 1024K words of main memory housed in a separate cabinet	493,469	1,542	11,744	9,308
3062-96	1100/61 Model C2 Standard Processing Complex; same as 3062-99 but with Extended Instruction Set	532,050	1,658	12,662	10,036
3072-99	1100/61 Model C1 Standard Processing Complex; same as 3042-99 but supports IOU Expansion F3751-00	336,519	1,342	8,007	6,346
3072-96	1100/61 Model C2 Standard Processing Complex; same as 3042-96 but supports IOU Expansion F3751-00	375,100	1,458	8,925	7,074
3042-75	1100/61 Model E1 Medium Performance Processing Complex; includes CPU with standard instruction set, 512K words of main memory, 2K-word high-speed buffer, and integrated multiprocessor capability; an IOU with one block multiplexer and one 4-channel word channel module; an SSP; a system console with printer; and a maintenance console	547,519	1,692	13,035	10,328
3042-72	1100/61 Model E2 Medium Performance Processing Complex; same as 3042-75 but with Extended Instruction Set	586,100	1,808	13,951	11,056
3062-75	1100/61 Model E1 Medium Performance Processing Complex; same as 3042-75 but with 1024K words of main memory housed in a separate cabinet	704,469	1,892	16,772	13,290
3062-72	1100/61 Model E2 Medium Performance Processing Complex; same as 3062-75 but with Extended Instruction Set	743,050	2,008	17,688	14,018
3072-75	1100/61 Model E1 Medium Performance Processing Complex; same as 3042-75 but supports IOU Expansion F3751-00	547,519	1,692	13,035	10,328
3072-72	1100/61 Model E2 Medium Performance Processing Complex; same as 3042-72 but supports IOU Expansion F3751-00	586,100	1,808	13,951	11,056
3042-93	1100/61 Model H1 High Performance Processing Complex; includes CPU with standard instruction set, 512K words of main memory, 8K-word high-speed buffer, and integrated multiprocessor capability; an IOU with one block multiplexer and one 4-word word channel module; an SSP; a system console with printer; and a maintenance console	693,177	2,042	16,505	13,077
3042-90	1100/61 Model H2 High Performance Processing Complex; same as 3042-93 but with Extended Instruction Set	731,759	2,158	17,423	13,805
3062-93	1100/61 Model H1 High Performance Processing Complex; same as 3042-93 but with 1024K words of main memory housed in a separate cabinet	850,127	2,242	20,242	16,039
3062-90	1100/61 Model H2 High Performance Processing Complex; same as 3062-93 but with Extended Instruction Set	888,709	2,358	21,160	16,767
3072-93	1100/61 Model H1 High Performance Processing Complex; same as 3042-93 but supports IOU Expansion F3751-00	693,177	2,042	16,505	13,077
3072-90	1100/61 Model H2 High Performance Processing Complex; same as 3042-90 but supports IOU Expansion F3751-00	731,759	2,158	17,423	13,805
3042-81	1100/62 Model E1 Multiprocessor Complex; includes two CPUs with standard instruction set, 1024K words of main memory, and a 2K-word buffer in each CPU; two IOUs with one block multiplexer and one 4-word word channel module each; two SSPs; two system consoles with printers; and one maintenance console	938,254	3,499	22,340	17,703

*Lease charges do not include maintenance.

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
PROCESSORS (Continued)					
3042-78	1100/62 Model E2 Multiprocessor Complex; same as 3042-81 but with Extended Instruction Set	1,015,416	3,732	24,175	19,159
3062-81	1100/62 Model E1 Multiprocessor Complex; same as 3042-81 but with main memory housed in a separate cabinet	1,019,654	3,499	24,278	19,240
3062-78	1100/62 Model E2 Multiprocessor Complex; same as 3062-81 but with Extended Instruction Set	1,096,816	3,732	26,113	20,696
3072-81	1100/62 Model E1 Medium Performance Processing Complex; same as 3042-81 but supports IOU Expansion F3751-00	938,254	3,499	22,340	17,703
3072-78	1100/62 Model E2 Medium Performance Processing Complex; same as 3042-78 but supports IOU Expansion F3751-00	1,015,416	3,732	24,175	19,159
3064-99	1100/60 Attached Virtual Processor; includes CPU with 512K to 1024K words of main memory and 32K-byte buffer; main storage interface unit; interprocessor interface; one byte multiplexer channel; one externally specified index attachment; VS/9 facility; AVP console; and Attached Processor Control Software	132,040	455	2,669	2,357
PROCESSOR OPTIONS					
K3919-99/-98	1100/61 Model B1 to Model C1 Upgrade	100,000	342	2,376	1,883
F2917-00	Model Upgrade; makes 1100/61 Model C1, E1, or H1 into equivalent of C2, E2, or H2 through the addition of the Extended Instruction Set	96,453	117	2,456	1,947
1952-99	Model Upgrade; makes 1100/61 Model C1 into H1 or C2 into H2	356,659	700	9,063	7,201
1952-96	Model Upgrade; makes 1100/61 Model C1 into E1 or C2 into E2	211,000	350	5,379	4,262
1952-95	Model Upgrade; makes 1100/61 Model E1 into H1 or E2 into H2; two required to upgrade a multiprocessor system	224,050	350	5,706	4,521
3042-69	Model E1 Multiprocessing Upgrade; adds a second E1 processing complex to 3042-75 together with transfer switches to allow either System Support Processor (SSP) to attach to the maintenance console and the remote maintenance modem	469,127	1,808	11,172	8,851
3042-66	Model E2 Multiprocessing Upgrade; same as 3042-69 but adds E2 to E2	507,708	1,925	12,090	9,579
3062-69	Model E1 Multiprocessing Upgrade; adds a second E1 processing complex to 3062-75 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	393,577	1,608	9,373	7,426
3062-66	Model E2 Multiprocessing Upgrade; same as 3062-69 but adds E2 to E2	432,158	1,725	10,291	8,154
3072-69	Model E1 Multiprocessing Upgrade; same as 3042-69 but adds 3072-75 and supports IOU Expansion F3751-00	469,127	1,808	11,172	8,851
3072-66	Model E2 Multiprocessing Upgrade; same as 3042-66 but supports IOU Expansion F3751-00	507,708	1,925	12,090	9,579
3042-87	Model H1 Multiprocessing Upgrade; adds a second H1 processing complex to 3042-93 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	693,177	2,158	16,504	13,077
3042-84	Model H2 Multiprocessing Upgrade; same as 3042-87 but adds H2 to H2	731,759	2,275	17,423	13,805
3062-87	Model H1 Multiprocessing Upgrade; adds second H1 processing complex to 3062-93 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	617,627	1,958	14,705	11,652
3062-84	Model H2 Multiprocessing Upgrade; same as 3062-87 but adds H2 to H2	656,209	2,075	15,624	12,380
3062-63	Model H1 Multiprocessing Upgrade; adds a third or fourth H1 processing complex to 3062-87 (or upgraded 3042 equivalent) to form an 1100/63 or 1100/64 system; does not include main memory, SSP, or system console	597,625	1,800	14,229	11,276
3062-62	Model H2 Multiprocessing Upgrade; same as 3062-63 but adds H2 to H2	636,207	1,916	15,148	12,004
3072-87	Model H1 Multiprocessing Ugrade; same as 3042-87 but adds 3072-93 and supports IOU Expansion F3751-00	693,177	2,158	16,504	13,077
3072-84	Model H2 Multiprocessing Upgrade; same as 3042-84 but supports IOU Expansion F3751-00	731,759	2,275	17,423	13,805
F2869-00	Performance Monitor; provides scannable buffered counters within a processing complex to allow the system support processor to collect selected performance parameters; one required per complex	32,151	23	765	607
F2688-00	IOU Expansion for 3042 systems; provides space for up to two word channel modules and one block multiplexer channel; one per processor complex; mutually exclusive with F2916-00	10,903	23	258	206
F2688-01	IOU Expansion; same as F2688-00 but for 3062 and 3072 systems; mutually exclusive with F2916-01 and F3751-00	10,903	23	258	206

*Lease charges do not include maintenance.

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
PROCESSOR OPTIONS (Continued)					
F2916-00	IOU Expansion for 3042 systems; provides space for up to two block multiplexer channels and one word channel; one per processor complex; mutually exclusive with F2688-00	10,903	23	258	206
F2916-01	IOU Expansion; same as F2916-00 but for 3062 and 3072 systems; mutually exclusive with F2688-01 and F3751-01	10,903	23	258	206
F3751-00	IOU Expansion for 3062 and 3072 systems only; provides space for four additional block multiplexer channels; one per processor complex; mutually exclusive with F2688-01 and F2916-01	16,500	75	450	350
F2684-00	Word Channel Module for 3042 systems; provides four additional independent word channel interfaces; for use with F2688-00 and F2916-00	20,573	105	491	390
F2684-01	Word Channel Module; same as F2684-00 but for 3062 and 3072 systems; for use in F2688-01 or F2916-01	20,573	105	491	390
F2690-00	Block Multiplexer Channel for 3042 systems; provides interface for up to eight byte-oriented control units; for use with F2688-00 or F2916-00	17,334	70	412	327
F2690-01	Block Multiplexer Channel; same as F2690-00 but for 3062 and 3072 systems; for use in F2688-01, F2916-01, or F3751-00	17,334	70	412	327
F2867-00	Shared Peripheral Interface (SPI) Control; provides capability to control up to six word control units, each with up to four SPI interfaces	16,105	23	385	306
F2904-00	Byte Channel Transfer Switch Control; provides capability to control one fully configured 4 by 8 byte channel transfer switch; maximum of 2 F2867-00 or F2904-00 per processing complex	16,105	23	385	306
2521-00	Channel Transfer Switch for block multiplexer channels; free-standing cabinet contains operator controls for manual switching of 4 subsystem strings, a primary module with a 2x1 switch, and power and space for 4x8 switching	19,781	74	466	348
2521-02	Channel Transfer Switch for remote operation	19,781	74	466	348
F2600-00	Primary Module Expansion; adds a switch for one subsystem string; maximum of 3 per 2521-00 or F2601-00; maximum of one per F2601-01	586	—	14	11
F2601-00	Additional Primary Module; adds a second 2x1 primary module and operator control for switching up to 4 subsystem strings	10,476	40	260	185
F2601-02	Additional Primary Module for remote operation	10,476	40	260	185
F2601-01	Secondary Module; for applications requiring 2-by switching capability when up to 4 switchable strings can be configured among independent 2-by switches; may be expanded by one F2600-00	10,476	40	260	185
F2601-03	Secondary Module; same as F2601-01 but for remote operation	10,476	40	260	185
F2602-00	Secondary Module; expands primary module from 2x1 to 4x1; two maximum	7,127	31	176	127
F2602-01	Secondary Module; same as F2602-00 but for remote operation	7,127	31	176	127
F2603-00	Secondary Module; allows expansion of 4-by switching by one subsystem string; maximum of 3 with each F2602-00; requires F2600-00	586	—	14	11
F2604-00	DC Power Redundancy; adds back-up DC supplies for hot-standby dynamic power redundancy	2,680	12	66	47
3542-97	Additional System Console; attaches to SSP; includes CRT console with keyboard, 200-cps bidirectional printer, and console table; maximum of two 3542-97 or 3542-94 per SSP	28,627	129	680	538
3542-94	Auxiliary Console; same as 3542-97 but without the printer; maximum of two 3542-97 or 3542-94 per processing complex	11,574	70	274	216
0786-02	Console Printer; up to 3 per console allowed; requires F1247-01 and F2656-01 for attachment to 3542-94	6,594	64	177	148
F2656-01	Terminal Interface; required to interface console printer to any 1100/60 console	422	—	11	9
F1247-01	Auxiliary Interface; required to interface console printer to 3542-94 console	327	—	11	8
2522-01	Transfer Switch; allows console to be switched between two SSPs	1,575	—	40	30
MEMORY					
K2687-00	Memory Storage Unit Expansion for 3042 and for 3072 Model B1 systems; provides additional 256K words of storage; maximum of two per processing complex (maximum of 1024K words for a uniprocessor or 2048K words for a multiprocessor)	32,151	59	819	649
7049-98	Memory Upgrade; upgrades a 3042 or 3072 system to an equivalent 3062; expands a uniprocessor (UP) system from 512K words of main memory to 1024K words in a separate storage cabinet; may be further expanded to 4096K words by adding up to 3 F3368-99 storage expansions. Multiprocessor (MP) systems require two 7049-98's, which expand the system to 2048K words. Model E and H UP or MP systems can also have 7049-99 MSUs plus expansions for a total capacity of 8192K words (not available for Model B1)	182,500	200	4,679	3,685
7049-97	Memory Upgrade; similar to 7049-98, but expansion is from 768K to 2048K words; two F3368-99 expansions can be added. MP systems require two 7049-97's. Model E and H UP or MP systems can also have a 7049-99 MSU plus expansions	157,500	138	4,038	3,180

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
MEMORY (Continued)					
7049-96	Memory Upgrade; similar to 7049-98, but expansion is from 1024K to 2048K words; two F3368-99 expansions can be added. MP systems require two 7049-96's. Model E and H UP or MP systems can also have a 7049-99 MSU plus expansions	132,500	100	3,397	2,675
7049-99	Main Storage Unit Expansion; adds a second MSU with 1024K words of memory to a 3062 (or equivalent) Model E or H processor; may be expanded to 4096K words by adding up to 3 F3368-99 expansions	232,500	400	5,812	4,695
F3368-99	Storage Expansion; adds 1024K words of memory to 3062 processors or 7049 MSUs	100,000	100	2,500	2,020
MASS STORAGE					
5012-99	FH-432/FH-1782 Drum Control; controls one to eight 6016-00 or 6015-00 drums in any combination	102,720	509	2,247	1,605
F0929-00	Write Lockout Feature for 5012-99 drum control	1,392	5	32	22
F0930-00	Shared Peripheral Interface for 5012-99 drum control; multiprocessor application only	22,608	48	495	355
6016-00	FH-432 Drum; 256K words	52,848	210	1,271	825
6015-00	FH-1782 Drum; 2048K words	146,064	585	3,512	2,280
F0786-01	Dual Channel Feature for 6016-00 drum	3,024	28	72	47
F0767-00	Dual Channel Feature for 6015-00 drum	3,024	32	69	47
8407-00	8407 Diskette Subsystem; includes control unit and auto-load diskette drive; stores up to 20 one-megabyte diskettes	22,000	150	514	412
8407-02	8407 Diskette Drive; requires 8407-00	6,000	40	172	132
F3470-00	Translate Table; performs character translation; 512 bytes	3,640	17	104	78
5039-91	8433/8430 Control for up to eight 8430 or 8433 disk drives; minimum two disk drives per subsystem	54,000	374	1,971	1,282
F2047-00	Drive Expansion Feature for the 5039-91; provides for up to 16 8433/8430 drives to be attached to the 5039-91	5,760	51	211	137
8430-99	8430 Disk Drive; removable disk media; minimum of two drives per system	18,720	162	684	444
F1230-00	Disk Pack for the 8430-99; 17 million words	1,440	—	53	35
8433-00	8433 Disk Drive; removable disk media; minimum of two drives per system	27,360	237	997	649
F1223-00	Disk Pack for the 8433-00; 34 million words	1,820	—	66	43
F2342-00	Disk Drive Upgrade; converts 8430-99 to 8433-00	8,640	75	313	205
F2021-00	8433/8430 Dual Access Feature; provides dual access and simultaneous read/read, read/write, write/read, or write/write on any two 8433-00 or 8430-99	1,630	5	59	39
5046-99	8430/8433/8434 Control; controls up to 16 8430, 8433 or 8434 disk drives; maximum 866M words of storage; requies minimum of two disk drives	102,000	509	3,156	2,051
5046-97	8430/8433/8434 Dual Control; for dual-access subsystem operation; requires two channels	176,448	889	5,714	3,714
8434-99	8434 Disk Storage; provides two single-spindle disk drives with non-removable pack; 54.18M words per drive	66,600	288	2,439	1,583
F2561-00	32-Device Capability; allows up to 32 8430, 8433, or 8434 disk drives to be intermixed on one 5046-99 control; two required for 5046-97 dual control	7,680	51	211	137
F2021-99	8434 Dual Access; provides simultaneous read/write, read/read, write/read, and write/write on any two 8434 disk drives; requires 5046-97 dual control	2,688	17	64	48
F2555-00	Shared Peripheral Interface; provides an additional I/O interface for the 5046-99/97 controls	6,600	37	158	117
5046-95	8430/8433/8450 Control; provides control for up to 16 8450 disk drives and power for up to four sets of four drives of any type (i.e., 8430/8433 or 8450); requires minimum of two disk drives of the same type	102,000	509	3,077	2,051
5046-93	8430/8433/8450 Dual Control; two control units; each with the same characteristics and restrictions as the 5046-95 control; requires two F2838-00 8450 capability expansions or two F2720-00 8430/8433 capability expansions	176,448	889	5,417	3,714
F2838-00	8450 Capability Expansion; allows 5046-95 control to handle up to 32 8450 disk drives; requires 2837-00 power control expansion (excludes use of F2720-00 8430/8433 capability)	6,000	57	171	114
F2720-00	8430/8433 Capability Expansion; allows 5046-95 control to handle up to 16 8430 or 8433 disk drives (excludes use of F2838-00 8450 capability)	2,400	12	68	48
F2837-00	Power Control Expansion; required when total number of disk drives exceeds 16; two required for 5046-93 dual control	7,680	51	211	137
F2555-00	Shared Peripheral Interface; multiprocessor, allows 5046-95 to connect to two separate 1100 Series processors, two required for 5046-93 control	6,600	37	158	117

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
MASS STORAGE (Continued)					
8450-99	8450 Disk Storage; provides two disk drives using non-interchangeable data module; 54M words of storage per drive	66,600	317	2,439	1,583
8450-97	8450 Disk Storage; same as 8450-99, but also includes 194K words of fixed-head storage	74,600	350	2,723	1,811
F2717-99	8450 Fixed-Head Conversion; converts 8450-99 disk storage unit to an 8450-97 disk storage unit	13,600	31	285	228
F2718-99	8450 Dual Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write on any two 8450 disk drives; requires two 5046 controls	2,688	17	64	48
5056-99	8470 Disk Subsystem; includes controller for up to eight 8470 drives and one 8470 drive without fixed heads	87,200	327	2,473	1,843
5056-97	With fixed heads for up to 338,688 words additional capacity	94,000	349	2,615	1,937
5056-95	8470 Disk Subsystem; includes two controllers each having capacity for up to eight 8470 drives and two 8470 drives; each drive has dual access feature but not fixed head feature	162,000	610	4,594	3,402
5056-93	With fixed-head feature in each drive	175,600	654	4,877	3,612
5056-91	8470 Disk Subsystem; same as 5056-95 but with four drives	224,000	844	6,353	4,704
5056-89	With fixed-head feature in each drive	251,200	931	6,920	5,124
5056-87	8470 Disk Subsystem; same as 5056-95 but with eight drives	328,600	1,310	9,314	6,899
5056-85	With fixed-head feature in each drive	383,000	1,485	10,448	7,739
5056-83	8470 Disk Control; provides second control for dual accessing	102,000	467	2,835	1,890
F2994-00	Four Channel Capability for 5056-83	8,090	34	179	131
F3192-00	8430/8433 Attachment; allows up to eight 8430/8433 drives on 5056 control unit; up to three are allowed	9,840	53	290	215
F3192-01	8450 Attachment; allows up to eight 8450 drives on 5056 control unit; up to three are allowed	11,680	53	290	215
F3192-02	8470/8480 Attachment; allows up to eight additional 8470 or two 8480 drives on single control unit; up to three are allowed	4,000	19	100	74
F2837-00	Power Control Expansion; required on control unit when over 16 drives are configured	7,680	51	211	137
8470-99	8470 Disk Drive without fixed heads; 90M words of storage	33,600	120	992	735
8470-97	With fixed heads	38,400	144	1,134	840
F2717-03	8470 Conversion Package; converts 8470-99 to 8470-97	6,800	24	150	111
F2718-00	8470 Dual Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write	2,688	16	56	44
5056-73	8480 Disk Subsystem; includes two dual-access control units and two 8480 disk units; supports up to eight 8480 units; a maximum of three attachment features may be added; all drives must have dual access	310,890	1,310	7,773	6,615
F2994-99	Four-Channel Capability; provides two additional channel interfaces; maximum of one per subsystem	16,180	68	358	262
F3192-99	8430/8433 Attachment; allows up to eight 8430/8433 drives on 5056-73 control	19,680	106	580	430
F3192-98	8450 Attachment; allows up to eight 8450 drives on 5056-73 control	23,360	106	580	430
F3192-97	8470/8480 Attachment; allows up to eight 8470 or two additional 8480 drives on 5056-73 control	8,000	38	200	148
F2837-99	Control Power Expansion; required when total number of drives in a subsystem exceeds 16	15,360	102	390	254
8480-99	8480 Disk Storage Unit; contains 4 spindles with a total capacity of 360M words; includes dual-access feature	92,240	456	2,212	1,847
8480-97	8480 Disk Storage Unit; same as 8480-99, but without dual access	84,240	436	2,040	1,700
F2718-02	8480 Dual-Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write	8,000	20	172	147
5057-99	Cache/Disk Processor; manages up to four 7053 cache storage units plus up to eight 8450 and eight 8470 or 8480 disk units (16 drives maximum)	104,700	355	2,795	2,105
7053-97	First Cache Storage Unit; 917,504 words of RAM; requires Segment Descriptor Table to operate in Cache/Disk mode; can be expanded to 3 million words via K3351-00	137,534	430	3,475	2,836
7053-96	Cache Storage Expansion Unit; 917,504 words; can be expanded to 3 million words via K3351-00	137,534	430	3,475	2,836
K3351-00	Cache Storage Expansion; provides additional 917,504 words of storage to 7053-96 or 7053-97; maximum of 3 per 7053	89,000	170	2,200	1,854
F3117-00	Segment Descriptor Table; 16K words of storage; required when 7053 is used in Cache/Disk mode	7,584	25	237	229
F3117-01	Segment Descriptor Table Expansion; provides additional 48K words; required when cache memory exceeds 917,504 words; F3117-00 is prerequisite	12,816	45	400	356
F3117-02	Segment Descriptor Table; 64K words of storage; used when 7053 is used in Cache/Disk mode and has more than 917,504 words of storage; mutually exclusive with F3117-00 and -01	20,400	70	637	585
F3118-00	Dual Access Feature for 7053-97; requires two 5057 processors	4,416	15	138	123
F3118-01	Dual Access Feature for 7053-96; requires two 5057 processors	4,416	15	138	123
F3567-00	8450 Capability Expansion; permits sixteen 8450 disk units on cache/disk system; precludes use of 8470 disks	11,680	50	276	205

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
MASS STORAGE (Continued)					
F3568-00	8470/8480 Capability Expansion; permits sixteen 8470 or four 8480 disk units on cache/disk system; precludes use of 8450 disks	11,680	50	276	205
F2994-00	Four-Channel Capability; expands channel interface capability to a total of four word channels	8,090	34	179	131
MAGNETIC TAPE UNITS					
5058-00	Uniservo 22 Subsystem; includes two Uniservo 22 tape drives and control for up to eight Uniservo 22 or Uniservo 24 drives	75,840	377	2,129	1,580
5058-02	Uniservo 22 Magnetic Tape Drives; includes two dual-density PE/NRZI drives; 1600/800 bpi, 9-track, 75 ips	47,040	245	1,320	980
5058-06	Uniservo 24 Subsystem; includes two Uniservo 24 tape drives and control for up to eight Uniservo 24 or Uniservo 22 drives	83,520	417	2,349	1,740
5058-08	Uniservo 24 Magnetic Tape Drives; includes two dual-density PE/NRZI drives; 1600/800 bpi, 9-track, 125 ips	54,720	285	1,540	1,140
F0825-00	Dual Channel Feature; provides non-simultaneous operation on two channels of one processor or one channel on each of two processors	4,593	31	110	89
F2627-00	Translation Feature; translation is ASCII/EBCDIC, fieldata/EBCDIC, or fieldata/ASCII	2,064	14	52	36
F2627-01	Second Translation Feature	2,064	14	52	36
5042-00	Uniservo 30 Control for up to eight 9-track, dual density (GCR/PE) Uniservo 30, 32, 34, or 36 drives	48,143	366	1,290	953
F2131-00	Adds 9-track NRZI to 5042-00; prerequisite for Uniservo 30 drives and all 7-track NRZI features	3,171	24	84	63
F2585-00	Translation Feature for 9-track drives on 5042 control; translation is in both directions involving ASCII/EBCDIC, fieldata/EBCDIC, and fieldata/ASCII	1,785	14	47	36
F2585-01	Second 9-track Translator; F2585-00 required	1,785	14	47	36
F2584-99	Adds 7-track NRZI to 5042-00; includes ASCII to BCD translator and data conversion	1,617	12	42	32
F2584-98	Translator is ASCII to fieldata	1,617	12	42	32
F2584-97	Translator is fieldata to BCD	1,617	12	42	32
F2135-00	Dual Channel Feature for the 5042-00; provides non-simultaneous access to the control from two block multiplexer channels; not software supported	5,229	40	138	104
F2137-00	Drive Expansion Feature for the 5042-00; provides for up to 16 Uniservo 30, 32, 34, or 36 drives to be attached to the 5042-00	835	5	22	15
0872-00	Uniservo 30 Magnetic Tape Drive; 9-track, dual density, PE/NRZI, 1600/800 bpi, 200 ips	30,335	230	860	601
0872-02	Uniservo 30 Magnetic Tape Drive; 7-track, NRZI, 800/556/200 bpi, 200 ips	30,335	230	860	601
F2123-00	Conversion Feature; converts 0872-02 to 0872-00	3,287	—	87	65
0873-00	Uniservo 32 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 75 ips	27,552	208	799	546
0873-02	Uniservo 34 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 125 ips	31,448	239	916	623
F2125-00	Conversion Feature; converts 0873-00 to 0873-02	4,011	31	106	80
0874-00	Uniservo 36 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 200 ips	33,674	256	982	667
PRINTERS					
0770-00	Line Printer and Control; 800 lpm with 48 character set	56,304	341	1,300	1,041
0770-02	1400 lpm	64,896	447	1,498	1,196
0770-04	2000 lpm	86,686	681	3,187	2,074
F1533-00	160 Print Positions for 0770 Series Printers	4,416	24	102	82
F1534-00	Expanded Character Set Control; required for other than 48-character print cartridges	2,880	5	66	53
F2230-00	Printer Upgrade; 0770-00 to 0770-02	8,592	106	198	155
F2230-01	Printer Upgrade; 0770-00 to 0770-04	30,382	228	1,159	559
F2230-02	Printer Upgrade; 0770-02 to 0770-04	21,790	122	961	404
F2822-00	Dynamic Advance Control; reduces slew rate by 50 percent to optimize stacking of light forms	300	—	8	7
	Print Cartridges for 0770 Series Printers:				
F1536-00	48-character Alphanumeric Business/Commercial	462	—	24	19
F1536-01	48-character Alphanumeric Scientific	462	—	24	19
F1536-03	48-character Alphanumeric for United Kingdom	462	—	24	19
F1536-06	48-character ANSI standard OCR-A	462	—	24	19
F1537-00	94-character ASCII Graphic (ANSI X3.4-1968)	462	—	24	19
F1537-03	68-character ISO Universal OCR-B	462	—	24	19
F1537-04	68-character OCR H-14 Universal	462	—	24	19
F1537-05	58-character Cobol/Fortran/Business	462	—	24	19
F1537-06	177-character International	462	—	24	19
F1537-09	24-character Numeric	462	—	24	19
F1537-11	68-character Universal OCR-A	462	—	24	19
F1537-12	68-character Universal ECMA-11 OCR-B	462	—	24	19
F1537-13	68-character Universal Univac 77L OCR-B	462	—	24	19

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
PRINTERS (Continued)					
F1537-14	63-character Modified Fortran	462	—	24	19
F1537-15	63-character Modified ASCII	462	—	24	19
F1537-19	384-character American Library Association	462	—	24	19
F1537-21	128-character OCR-A	462	—	24	19
F1537-23	94-character Optimized ASCII	462	—	24	19
F1537-24	68-character Optimized IOS Universal OCR-B (Cartridges are also available for languages other than English)	462	—	24	19
0776-00	Line Printer and Control; 760 lpm with 48 character set	36,570	261	958	765
0776-02	900 lpm	41,340	312	1,080	864
0776-04	1200 lpm	52,150	356	1,363	1,090
F2217-00	Printer Upgrade; 0776-00 to 0776-02	4,770	51	122	100
F2245-00	Expanded Character Set Control; required for character sets with more than 64 characters	1,910	5	50	40
	Print Cartridges for 0776 Series Printers:				
F2216-00	48-character Alphanumeric Business/Commercial	1,270	—	34	26
F2216-01	48-character Alphanumeric Scientific	1,270	—	34	26
F2216-07	24-character Numeric	1,270	—	34	26
F2216-08	63-character Modified Fortran	1,270	—	34	26
F2216-09	63-character Modified ASCII	1,270	—	34	26
F2216-10	48-character OCR-A	1,270	—	34	26
F2215-00	94-character ASCII	1,270	—	34	26
F2215-03	68-character ISO Universal OCR-B	1,270	—	34	26
F2215-04	68-character OCR H-14 Universal	1,270	—	34	26
F2215-05	58-character Cobol/Fortran/Business	1,270	—	34	26
F2215-11	68-character Universal OCR-A	1,270	—	34	26
F2215-12	68-character Universal ECMA-11 OCR-B	1,270	—	34	26
F2215-13	68-character Universal Univac 77L OCR-B	1,270	—	34	26
F2215-20	94-character Optimized ASCII	1,270	—	34	26
F2215-21	68-character Optimized ISO Universal OCR-B	1,270	—	34	26
F2215-23	128-character OCR-A	1,270	—	34	26
0777-97	On-Line Laser Printer; up to 21,000 lpm; includes controller, disk drive, PE tape drive, CRT console, forms splicing station, and diskette with 15 character sets	374,500	872	—	8,283
0777-87	On-Line Laser Printer; same as 0777-97 but includes two diskettes with 15 character sets each	374,500	872	—	8,283
0777-93	Off-Line Laser Printer; same as 0777-97, but operates off-line; requires F3777-00 for on-line operation	378,500	972	10,249	8,367
0777-83	Off-Line Laser Printer; same as 9777-93, but includes two diskettes with 15 character sets each	378,500	972	10,249	8,367
0777-81	Off-Line Laser Printer; same as 9777-83, but includes GCR tape drive	394,500	1,097	11,602	8,767
F3777-00	On-Line Channel Interface; provides the capability to connect an off-line 0777 printer to an 1100/60 system via the host block multiplexer channel	25,000	—	700	500
F3380-00/-01	Additional Character Sets; for 0777-97 and 0777-93	30	—	—	—
F2874-00	Character Font Expansion; up to 255 characters; for 0777-93 and 0777-97	3,640	16	104	78
F3815-00	Character Font Expansion; up to 255 characters; for 0777-83 and 0777-87	3,640	16	104	78
F3816-00	Character Font Expansion; up to 1024 characters; for 0777-81, 0777-83, and 0777-87	14,560	72	500	328
F3816-02	Character Font Expansion; up to 3200 characters; for 0777-81, 0777-83, and 0777-87	43,680	216	1,500	984
F3816-99	Character Font Upgrade; expands an 0777 printer with 1024-character font storage to 3200-character font storage	29,120	144	1,000	656
F3816-98	Character Font Expansion; same as F3816-00, but for field installation only on 0777-97 or 0777-93	14,560	72	500	328
F3816-97	Character Font Expansion; same as F3816-02, but for field installation only on 0777-97 or 0777-93	43,680	216	1,500	984
F3935-XX	Alternate Developer Station; for 0777-97 and 0777-93	14,500	22	810	613
F2876-00	Forms Overlay Capability	11,700	31	335	249
F3426-00	Overlay Transparencies	35	—	—	—
1963-00	Burster/Trimmer/Stacker	40,196	166	1,217	857
F3595-00	Forms Counter for 1963-00	1,580	5	38	32
F3598-00	Center Slitter for 1963-00; provides lengthwise separation of forms	900	10	21	18
F3601-00	One-Wide Roll Imprinter; for special printing on forms before bursting; requires 1963-00	1,060	25	25	21
F3601-01	Two-Wide Roll Imprinters; same as F3601-00, but provides two-wide printing	1,520	25	45	38
PUNCHED CARD EQUIPMENT					
0604-99	Card Punch and Control; 250 cpm	31,968	230	664	536
0716-89	Card Reader and Control; 1000 cpm; comes with code translator; EBCDIC, ASCII, compressed code, or fieldata code	15,504	154	358	253
F1487-00	51-Column Card Read Feature	1,968	16	45	32
F1487-01	66-Column Card Read Feature	1,968	16	45	32

*Lease charges do not include maintenance.

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
PUNCHED CARD EQUIPMENT (Continued)					
F1488-00	Validity Check	816	—	18	14
F1498-00	Stacker Feature; permits the alternate filling of stackers one and two when in the stop-on-error mode	528	—	12	8
F1486-00	Translate Mode Conversion; from EBCDIC to ASCII	105	—	—	—
F1486-01	Compressed Code to ASCII	105	—	—	—
F1486-02	ASCII to EBCDIC	105	—	—	—
F1486-03	Compressed Code to EBCDIC	105	—	—	—
F1486-04	ASCII to Compressed Code	105	—	—	—
F1486-05	EBCDIC to Compressed Code	105	—	—	—
F1486-06	To Fieldata Code	100	—	—	—
F1530-00	Adds a second translator to translate mode under program control	1,104	5	25	18
GENERAL COMMUNICATIONS SUBSYSTEM					
8583-00	General Communications Subsystem (GCS); includes Communications Terminal Controller (CTC); houses maximum of 32 communications terminals with interface or communication terminal dialers	14,640	74	511	386
F1971-00	Expansion Power Supply; required when 24 or more terminals are included in the GCS configuration	1,630	5	57	43
F1972-00	Spare CTC for controlling up to 32 lines in ESI mode on an I/O channel	7,200	44	248	190
F1973-00	Communication Terminal Asynchronous; up to 2400 bps; asynchronous bit serial transmission	1,250	10	43	33
F1973-01	Communication Terminal Asynchronous; same as F1973-00, but with external interrupt capability	2,880	17	101	76
F1973-02	Communication Terminal Asynchronous VII; provides for block parity generation and checking	2,590	17	91	69
F1974-00	Communications Terminal Synchronous—Standard; up to 50,000 bps; synchronous bit serial transmission	1,820	14	63	49
F1974-01	Communications Terminal Synchronous; same as F1974-00, but with external interrupt capability	3,410	22	120	90
F1974-02	Communications Terminal Synchronous VII; provides for block parity and checking	3,070	22	108	81
F1975-00	Communications Terminal Synchronous; up to 56,000 bps, bit serial transmission	2,880	21	114	76
F1976-00	High-Level Communications Terminal; provides capability to handle bit-oriented Data Link Control, up to 56,000 bps	3,600	23	127	95
F1977-99	Communication Terminal Dialer	530	3	18	14
F1978-00	Communication Interface—Telegraph	190	1	6	4
F1979-00	Communication Interface—Modem	335	2	12	8
F1979-01	Identical to CI—modem (1979-00) except permits use of a modem not having a receive clock	530	3	18	14
F1980-00	Communication Interface—High-Speed (allows connection of a CTS—Std. or CTS—VII to the CCITT V.35 interface)	670	4	23	18
F1980-01	Communication Interface (allows connection of a CTS—Std. or CTS—VII to the ATT 303 modem or equivalent)	670	4	23	18
F1983-00	Spare Basic Clock	190	1	6	4
F1984-00	Expansion Clock (provides asynchronous timing rates not included in the basic clock)	190	1	6	4
F2072-00	Communications Interface (allows connection of a CTS—Std. or CTS-VII to a MIL 188C synchronous interface)	530	3	18	14
F2074-00	Communications Interface—automatic inbound bit rate detection	1,100	3	38	30
DISTRIBUTED COMMUNICATIONS PROCESSORS					
8597-99	Distributed Communications Processor/20 (DCP/20); free-standing unit including processor with 256K bytes of memory, operator panel, and maintenance panel; requires integrated flexible disk and controller plus free-standing flexible or cartridge disk; also requires a UTS 20 console or a UTS 400 attached to a communications line module	29,040	133	756	605
8597-01	DCP/20 Free-standing Expansion Cabinet; contains processor capable of performing I/O functions only; requires F1936-00 in basic cabinet; maximum of two per DCP/20 system	24,000	109	625	500
F3539-00	128K-byte Memory Increment; maximum of two per DCP/20	4,500	22	131	105
F3539-99	256K-byte Memory Increment; maximum of one per DCP/20	8,650	44	225	180
F2894-00	Line Module Expansion; provides for an additional 8 line modules in 8957-01	12,000	55	460	250
F2895-00	Active Line Indicator; provides a visual display of line activity on up to 16 half/full duplex communications lines	890	4	25	20
8406-04	Free-standing Diskette Drive; one megabyte of storage	3,600	22	103	79
F3145-00	Diskette Expansion; provides additional drive	2,160	11	61	47
8596-96	Distributed Communications Processor/40 (DCP/40); free-standing unit including processor with 512K bytes of memory, I/O cotnroller module, IOP, and control storage; reuires integrated flexible disk plus free-standing cartridge disk and communications line module; also requires a UTS 20 console or a UTS 400 attached to a communications line module	84,245	415	2,195	1,755

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	Monthly Charges* 5-Year Lease
DISTRIBUTED COMMUNICATIONS PROCESSORS (Continued)					
K1930-01	512K-byte Memory Increment; three may be added to 8596-96; additional memory uses 1945-00	15,600	116	410	325
1945-00	DCP/40 Free-standing Expansion Cabinet; contains power supply and power controller; accommodates up to four IOPs or three storage banks of up to 512K bytes each; maximum of three per system, only one of which may contain storage	27,060	134	705	565
F2942-00	Storage Controller; supplied with 128K bytes of memory; mounts in 1945-00; up to two F1929-99 and nine 128K-byte memory modules may be added	26,880	133	700	560
F1929-99	Storage Controller Expansion; includes 128K bytes of memory; provides control for 512K bytes of memory; required for storage banks three and four; mounts in F2942-00	13,950	71	365	290
F1933-00	IOP Controller Module; mounts in 1945-00; includes IOP and space for three additional IOPs and storage port expander	14,680	72	380	305
F2941-99	Second IOP Expansion; provides second IOP for 8596-96 or 1945-00; includes power for two more IOP expansions	14,920	74	390	310
F1932-99	Third IOP; mounts in 1945-00 or 8596-96; includes storage port expander	14,185	70	370	295
F1932-98	Fourth IOP; mounts in 1945-00 or 8596-96	10,635	52	280	220
F1928-00	Operator Station; work surface for local console and free-standing flexible disk unit	1,200	—	30	25
F1825-05	Active Line Indicator; provides a visual display of line activity on up to 16 communications line modules on an IOP; mounts on top of cabinet containing IOP	960	4	25	20
F1949-00	8-bit interface for 8406 flexible disk	1,045	4	30	25
F1800-02	Series 90 Byte Interface Switch; provides the capability to manually switch F1947-00 between selector/multiplexer channels of a single host CPU or two separate host CPUs	4,305	17	83	62
	Features for the DCP/20 and DCP/40:				
F1939-00	Integrated Flexible Disk Subsystem; includes 256K-byte flexible disk and controller; mounts in 8596-96 or 8597-99; one required	1,920	11	50	40
F1936-00	Storage Port Expander; provides a multiplexed interface to a single local storage access port for up to four requestors	3,550	17	95	75
F1946-02	1100 Series ISI Interface; provides a full-duplex ISI interface to a word channel; maximum of two per DCP/20 cabinet or four per DCP/40 cabinet	4,000	21	105	85
F1947-00	Series 90 Byte Interface; provides interface to Series 90 byte or block multiplexer channel; maximum of one per DCP/20 cabinet or two per DCP/40 cabinet	4,000	21	105	85
F1948-01	16-bit Peripheral Interface; provides interface to a peripheral subsystem; allows operation in 8- or 16-bit mode	3,000	15	80	65
F1941-00	Full-Duplex Interface to Asynchronous Data Sets; conforms to EIS RS-232-C and CCITT V.24 and V.28; data set rates up to 2400 bps	960	3	25	20
F1942-00	Full-Duplex Interface to Synchronous Data Sets; conforms to EIA RS-232-C and CCITT V.24 and V.28; data set rates up to 9600 bps	960	3	25	20
F3163-00	Full-Duplex Interface to Synchronous or Asynchronous Modems; conforms to EIA RS-232-C and CCITT V.24 and V.28; operates with Bell DDS up to 9600 bps or at data set rates up to 19,200 bps	1,275	7	35	30
F3163-01	Full-Duplex Interface to Public Data Networks; conforms to CCITT X.21 and X.25; operates at rates up to 19,200 bps	2,500	13	63	50
F3164-01	Full-Duplex Interface to Carrier Facilities; conforms to CCITT V.35; operates with UDLC protocol data formats (64K bps), V.35 facilities (48K bps), and Bell DDS and DSDS facilities (56K bps)	3,745	19	100	80
F3835-00	Remote Partitioning Capability; maximum of one on DCP/20 or four on DCP/40	960	5	25	20
F1945-00	Auto Dialing Line Module; interfaces to Bell 801 Automatic Calling Units or those conforming to CCITT V.24 and V.25	1,005	4	25	20
8408-02	Cartridge Disk Control; controls up to two F2380 drives	5,564	29	139	104
F2380-04	Fixed/Removable Cartridge Disk Drive; five megabytes fixed, five megabytes removable	17,750	114	439	314
F2187-00	Second I/O Interface for dual F2380 configuration	1,568	8	39	29
0871-01	Uniservo 10 Magnetic Tape Unit; 9-track, PE/NRZI, 1600/800 bps, 25 ips	13,962	85	318	239
F2721-00	Uniservo 10 Controller; controls up to two drives	10,320	51	284	215
F2879-00	AC Power Switch; provides remote control of second Uniservo 10	1,200	5	32	25
3560-93	UTS 20 DCP Console; includes 12-inch CRT, keyboard, and communications interface	3,225	30	128	97
0797-99	Printer; 80 cps; connects to DCP/20 or DCP/40	1,900	27	84	63
0798-99	Printer; 200 cps; bidirectional; connects to UTS 20	6,650	64	188	156

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SOFTWARE PRICES

		Monthly Lease Charge
System Processors		
6163-00	Terminal Security System	$ 189
6167-00	Sentry Security Control Processor	635
6158-00	Quota Input Processor (QUIP)	189
6162-00	Checkpoint/Restart	126
6133-00	Data Processor	63
Utility Processors		
6271-00	CULL Processor	25
F3859-00	Interactive CULL (IACULL)	25
6203-00	Fault Location of Interpretive Testing (FLIT)	116
6135-00	Sort/Merge	126
6246-00	Log Analyzer	120
6161-00	Performance Analysis Routines	252
6274-00	On-Line System Activity Monitor (OSAM)	250
Communications Processing		
6169-95	Communications Management System (CMS) 1100 DCP/20	500
6169-97	CMS 1100 DCP/40	600
6169-99	CMS 1100 GCS	650
6169-93	CMS 1100 DCP/GCS	650
6159-00	Processor Common Communications System (PCCS)	126
6136-95	DCP/20 Operating System	100
6136-01	DCP/40 Operating System	165
6136-00	DCP/40 DCP Emulate Operating System	114
6144-00	DCP/40 MCC Emulate Operating System	95
6276-00	BSC 3270 Terminal Handler	150
Data Base/Transaction Processing		
6292-00	Universal Data System (UDS) 1100 Control	200
6700-00	UDS Data Management System (DMS) 1100	1,050
6296-00	UDS Processor Common Input/Output System (PCIOS)	100
6293-00	UDS Relational Data Management System (RDMS) 1100	750
6299-00	UDS Data Dictionary System	500
6177-00	Define File Processor	63
6175-00	Integrated Recovery Utility (IRU)	383
6175-01	IRU Version II	400
6175-02	IRU Version III	450
6291-00	File Acquisition System (FAS)	150
6155-00	Data Management System (DMS) 1100	956
6176-00	Data Dictionary	383
6152-00	Processor Common Input/Output System (PCIOS)	63
6244-00	Information Management System (IMS) 1100	195
6237-00	Display Processing System (DPS) 1100	289
End User Products		
6146-00	Mapper 1100	978
6290-00	Advanced Information Service (Advise) 1100	300
6157-00	Query Language Processor (QLP) 1100	383
6156-00	Remote Processing System	252
Interactive Processing		
6170-01	Conversational Time-Sharing System (CTS) 1100	275
6147-00	High-Volume Time-Sharing (HVTS)	635
6262-00	Interactive Processing Facility (IPF) Command Language	275
6260-00	IPF Control	200
6263-00	IPF Procedures	350
6245-98	Edit 1100	290
6264-00	User Assistance	75
6261-00	Distributed Data Processing (DDP) 1100	100
Language Processors		
6165-00	General Syntax Analyzer	110
6172-00	APL 1100	509
6171-00	UBasic	126
6178-00	UBasic Syntax Analyzer	63
6153-00	ASCII Cobol	252
6149-00	Cobol Syntax Analyzer (BCOB)	126

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SOFTWARE PRICES

		Monthly Lease Charge
Language Processors (Continued)		
6154-00	ASCII Fortran	383
6150-00	Fortran Syntax Analyzer (BFTN)	126
6151-00	PL/1	252
6164-00	RPG 1100	126
6243-99	RPG II Group	130
6160-00	MACRO	126
6239-00	Programmers Advanced Debugging System (PADS) 1100	210
6251-00	Requirements and Development Processor (RDP)	1,000
Miscellaneous Products		
F3791-00	Univac Printer Interface Software (UPRINTS); provides interface to 0777 Printer	200
F3793-00	Cache Disk Interface Software (CADIS)	400